ICOM

SERVICE MANUAL

VHF FM TRANSCEIVER

IC-H16T

Icom Inc.

INTRODUCTION

This service manual contains information relative to the theoretical, physical, mechanical and electrical characteristics of the **IC-H16T** VHF FM TRANSCEIVER for selective calling with 5-Tone capability

ASSISTANCE

Twelve separate versions of the **IC-H16T** have been designed. This service manual covers each version. When using the manual each model can be referred to by the following assigned version numbers.

VERSION	FREQUENCY RANGE (MHz)	CHANNEL SPACING (kHz)	5-TONE SYSTEM
#01	146~174	25	CCIR
#02	146~174	12.5	CCIR
#03	146~174	12.5	CCIR
#11	146~174	25	CCIR
#12	146~174	12.5	CCIR
#13	146~174	12.5	CCIR
#14	146~174	25	ZVEI
#15	146~174	12.5	ZVEI
#16	146~174	12.5	EEA
#17	146~174	25	CCIR
#18	146~174	25	ZVEI
#19	146~174	12.5	ZVEI

If you require assistance or further information regarding the operation and capabilities of the **IC-H16T**, please contact your nearest authorized ICOM Dealer or ICOM Service Center.

ORDERING PARTS

For the fastest service, supply all of the following information when ordering parts from your dealer or ICOM Service Center:

1. Equipment model and serial number
2. Schematic part identifier (e.g., IC101, Q201)
3. Printed circuit board name and number (e.g., MAIN UNIT/B-1317C)
4. part number and name (e.g., 2SC2458 GR Transistor)
5. Quantity required (e.g., 3pcs.)

REPAIR NOTE

1. **DO NOT** open transceiver covers until the transceiver is disconnected from a power source.
2. **DO NOT** connect the transceiver to an external power source of more than 16V.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts.
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 sweep generator. Always connect a 30dB or 40dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
7. An insulated tuning tool **MUST BE** used for all adjustments.
8. Read the instructions of test equipment thoroughly before connecting the equipment to the transceiver.

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SECTION 1 SPECIFICATIONS

■ GENERAL

• Frequency coverage	:	146~174MHz
• Mode	:	16K0F3E (#01, #11, #14, #17, #18) 8K50F3E (#02, #03, #12, #13, #15, #16, #19)
• Channel spacing	:	25kHz (#01, #11, #14, #17, #18) 12.5kHz (#02, #03, #12, #13, #15, #16, #19)
• Number of channels	:	Up to 16
• Antenna impedance	:	50Ω unbalanced
• Power supply requirement	:	Suggested ICOM battery pack EXTERNAL DC POWER JACK: 12~15V DC (negative ground)
• Current drain (with CM-8)	:	Receive Standby 80mA Max. audio output 250mA Transmit HIGH 1.5A LOW 750mA
• Usable temperature range	:	−25°C~+60°C
• Frequency stability	:	±0.0005% (−25°C~+60°C)
• Dimensions (with CM-8)	:	65(W)×196(H)×38(D)mm (Projections not included.)
• Weight (with CM-8)	:	595g

■ TRANSMITTER

• Output power	:	HIGH 5W (with CM-7) 3W (with CM-8) LOW 1W
• Modulation system	:	Variable reactance frequency modulation
• Maximum frequency deviation	:	±5kHz (#01, #11, #14, #17, #18) ±2.5kHz (#02, #03, #12, #13, #15, #16, #19)
• Hum and noise	:	40dB
• Spurious emissions and harmonics	:	70dB

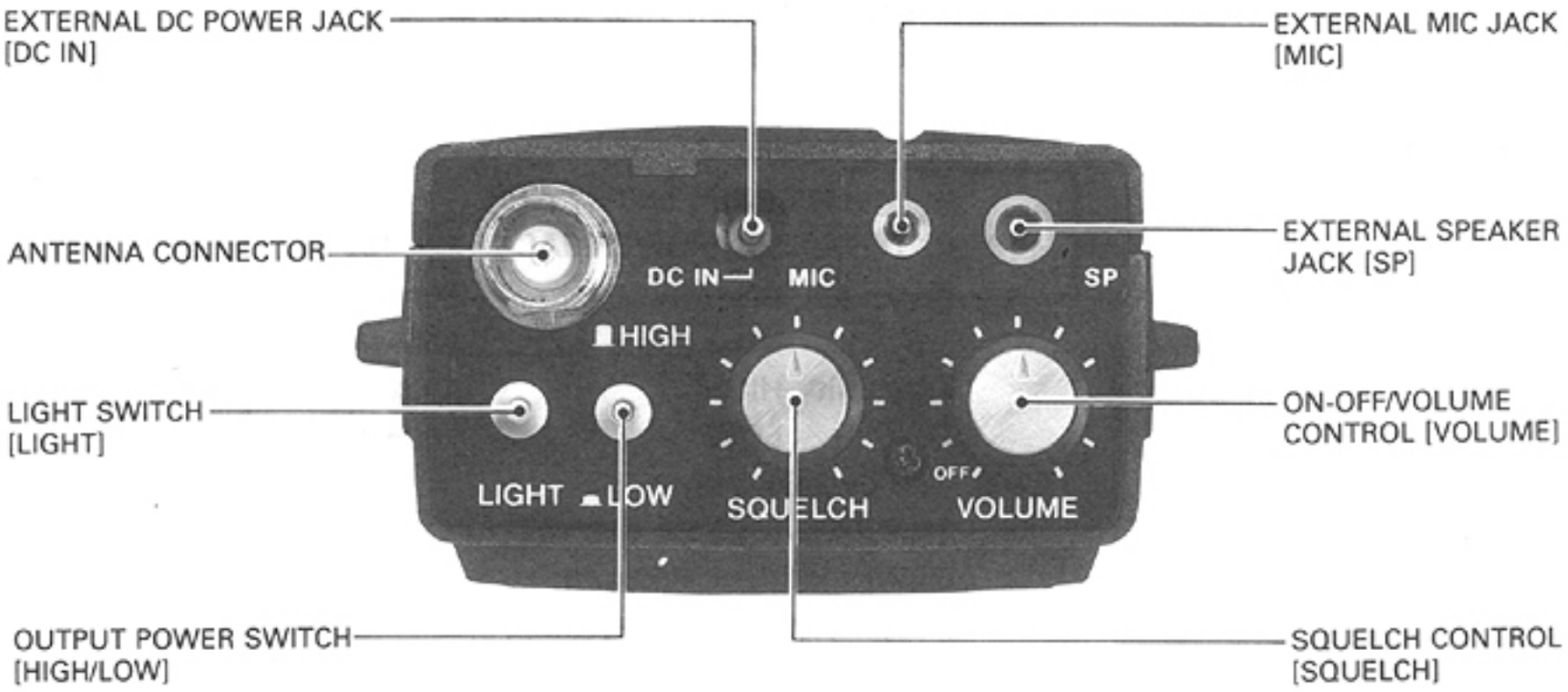
■ RECEIVER

• Receiver system	:	Double-conversion superheterodyne
• Intermediate frequencies	:	1st 21.8MHz 2nd 455kHz
• Sensitivity	:	0.35μV for 12dB SINAD
• Squelch sensitivity (threshold)	:	0.4μV
• Adjacent channel selectivity	:	70dB (#01, #11, #14, #17, #18) 60dB (#02, #03, #12, #13, #15, #16, #19)
• Intermodulation rejection	:	70dB
• Spurious and image rejection	:	70dB
• Audio output power (with CM-8)	:	500mW 10% distortion with an 8Ω load
• Audio output impedance	:	8Ω

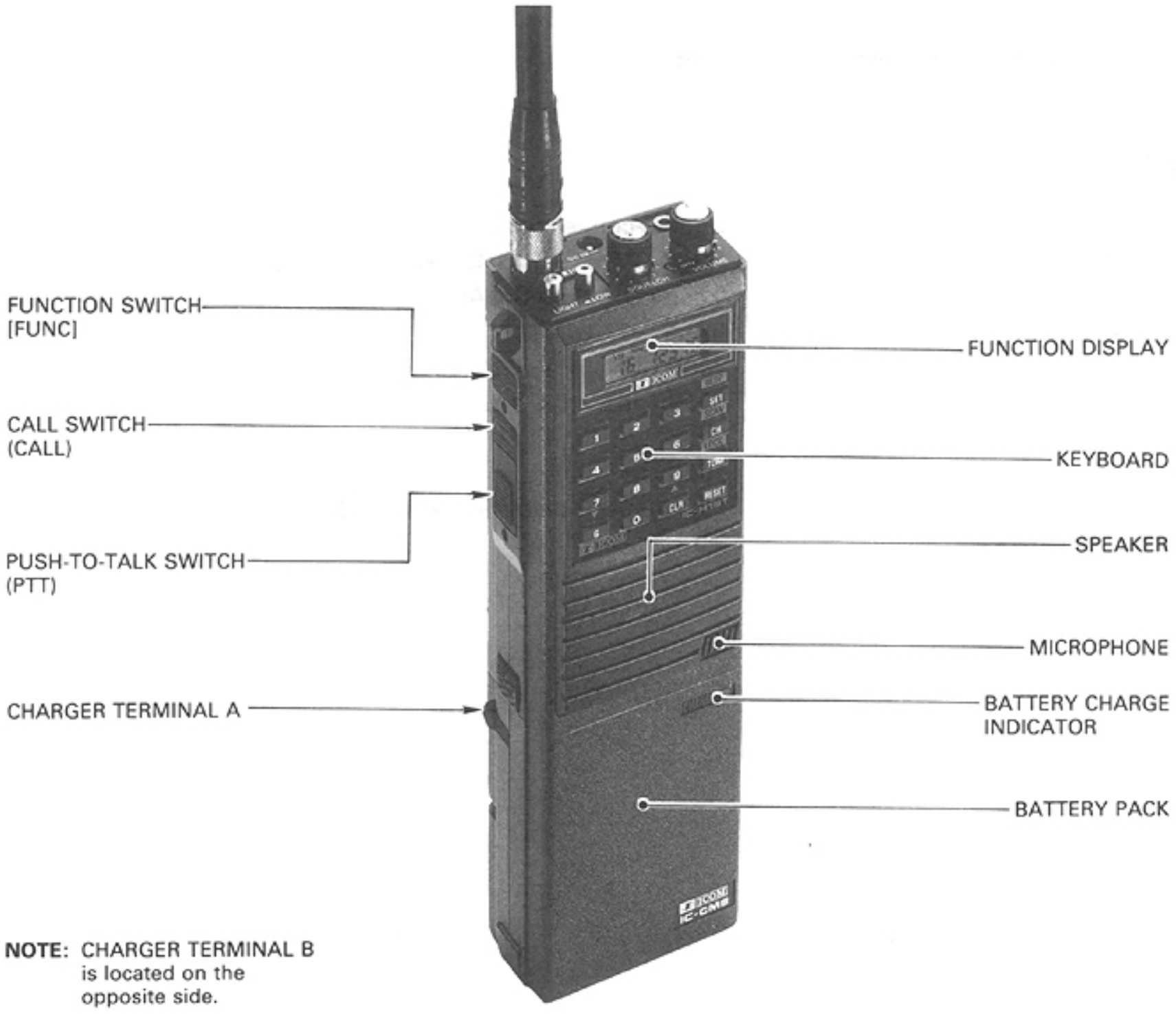
SECTION 2 OUTSIDE AND INSIDE VIEWS

2 - 1 OUTSIDE VIEWS

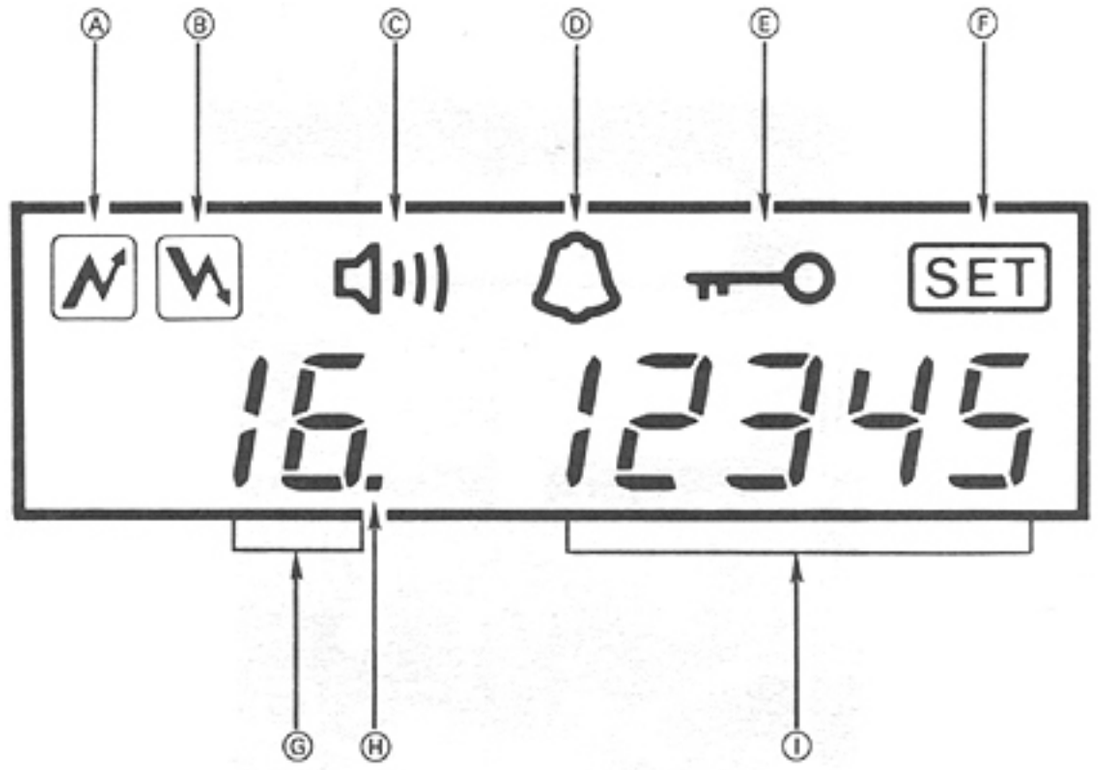
2 - 1 - 1 TOP PANEL



2 - 1 - 2 FRONT AND SIDE PANELS



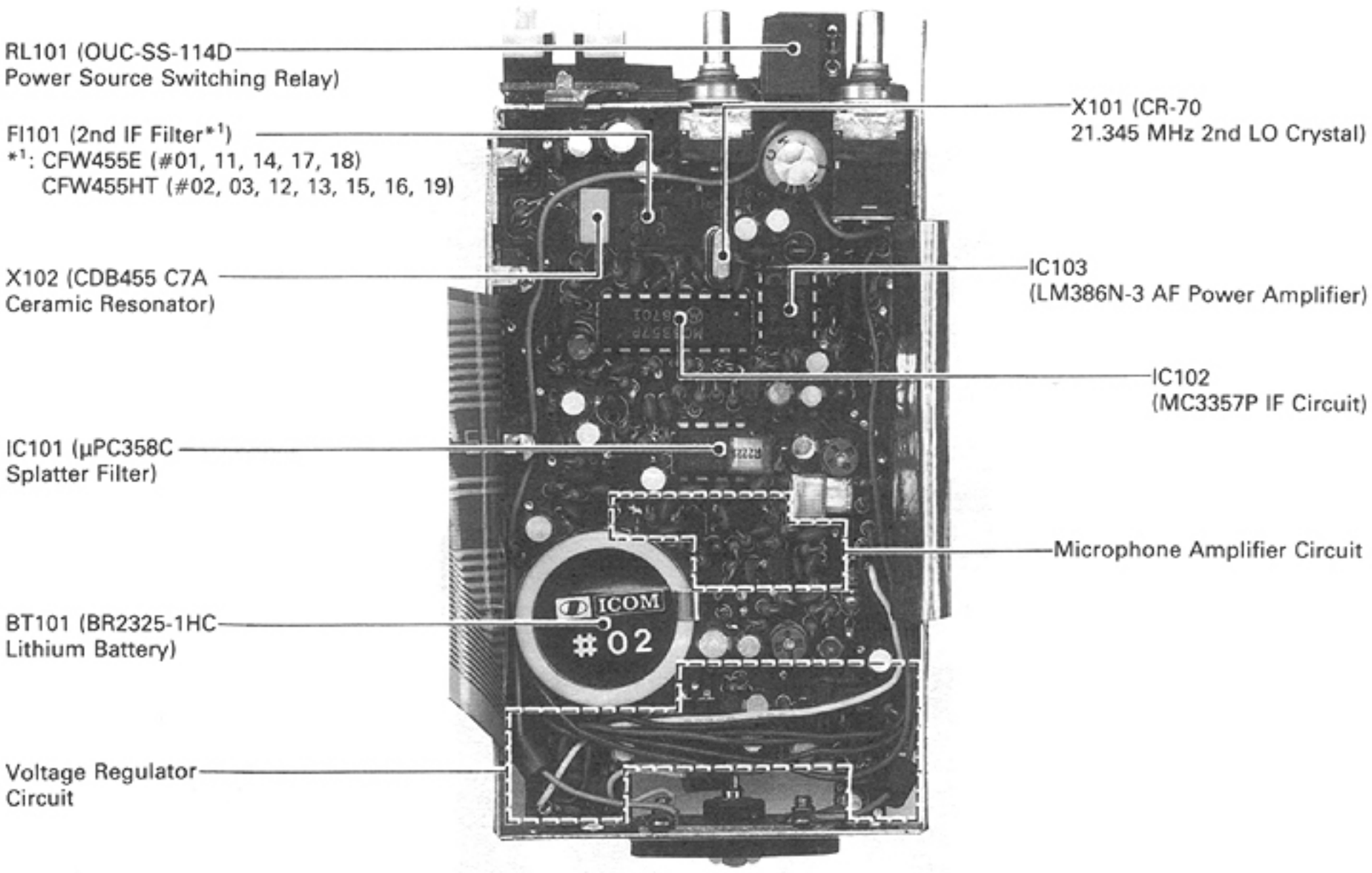
2 - 1 - 3 FUNCTION DISPLAY



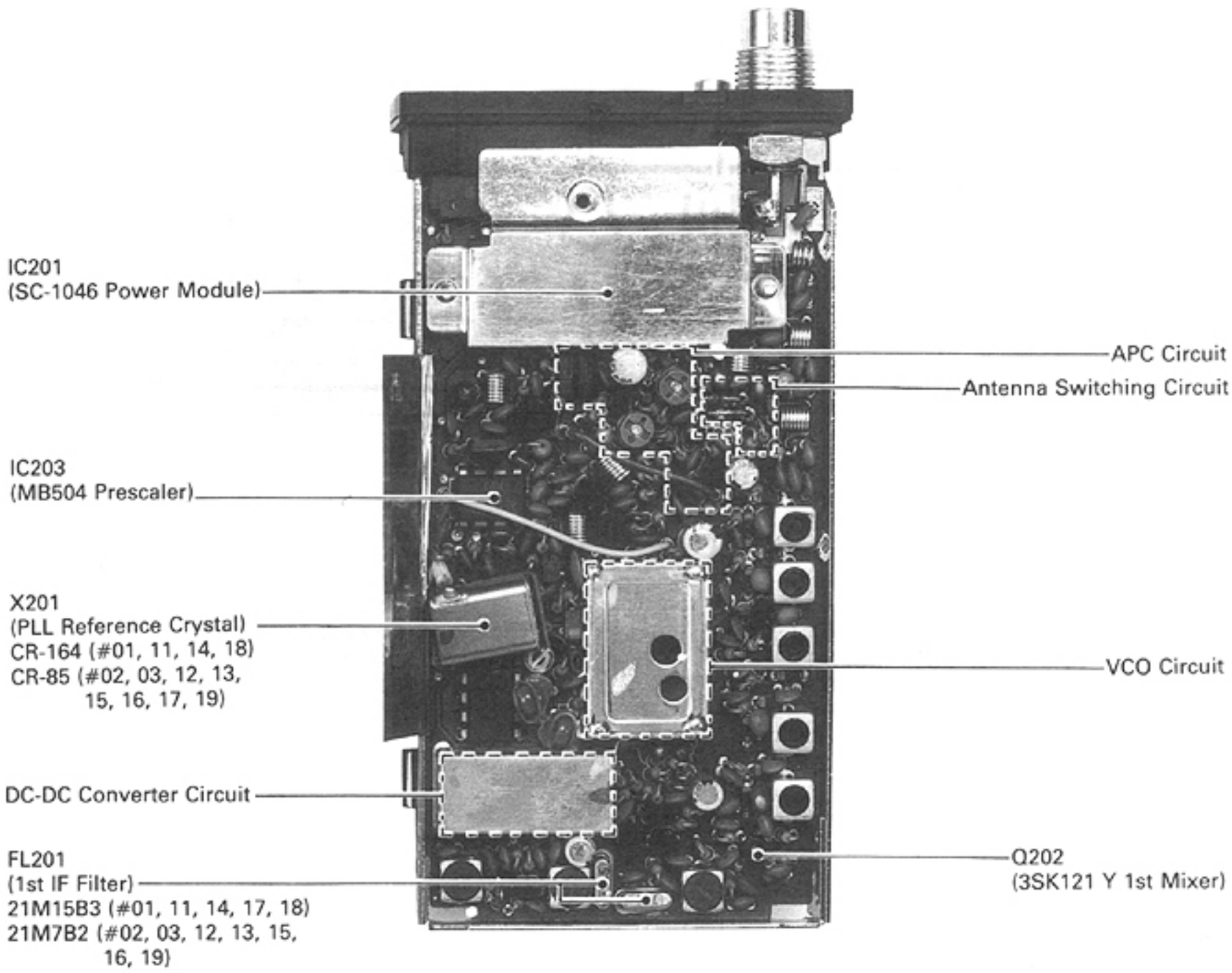
Ⓐ TRANSMIT INDICATOR
Ⓑ BUSY INDICATOR
Ⓒ MONITOR INDICATOR
Ⓓ CALL INDICATOR
Ⓔ LOCK INDICATOR
Ⓕ SET MODE INDICATOR
Ⓖ CHANNEL INDICATOR
Ⓗ SCAN CHANNEL INDICATOR
Ⓘ 5-TONE CODE INDICATOR

2 - 2 INSIDE VIEWS

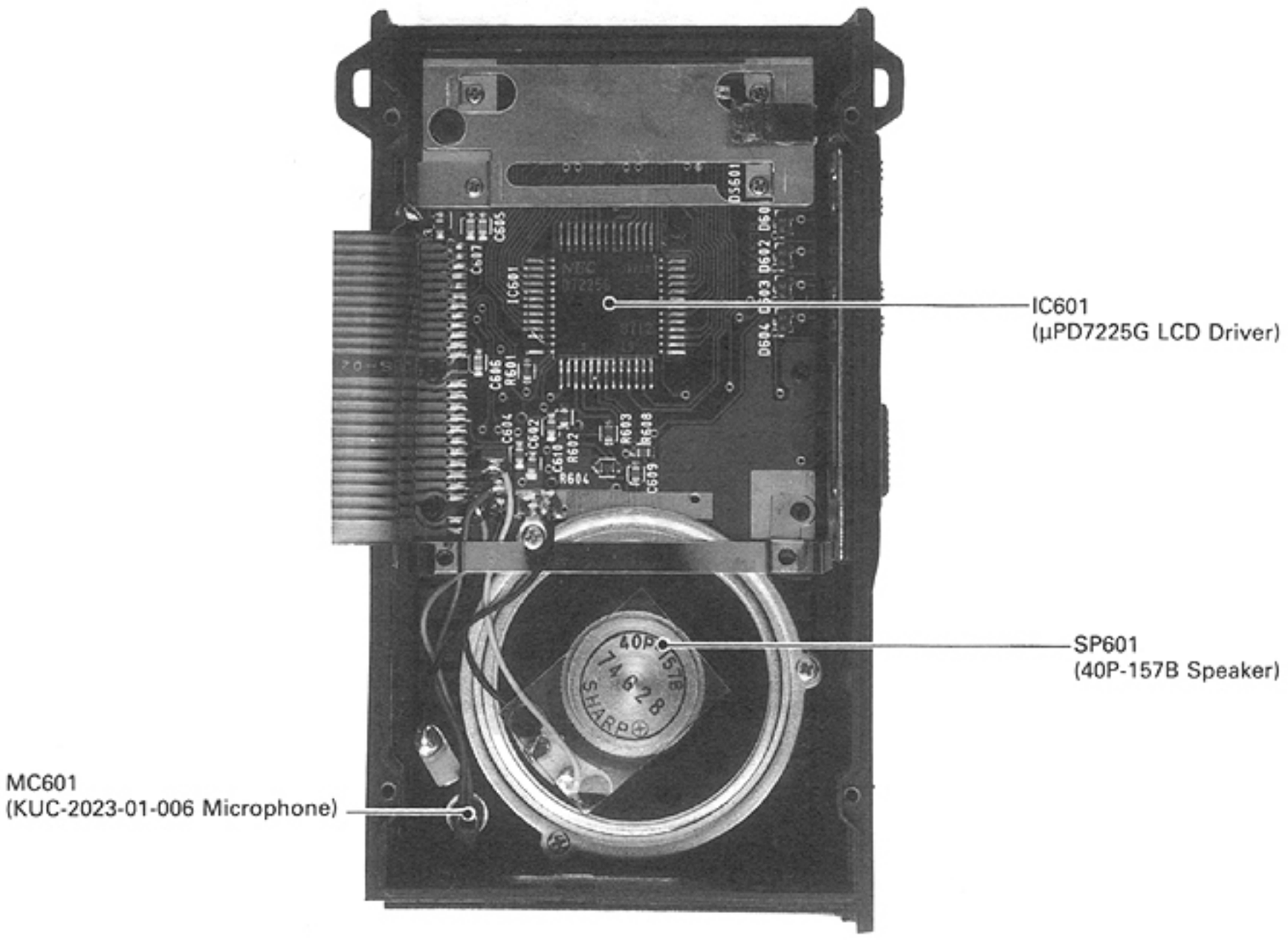
2 - 2 - 1 MAIN UNIT



2 - 2 - 2 PLL UNIT

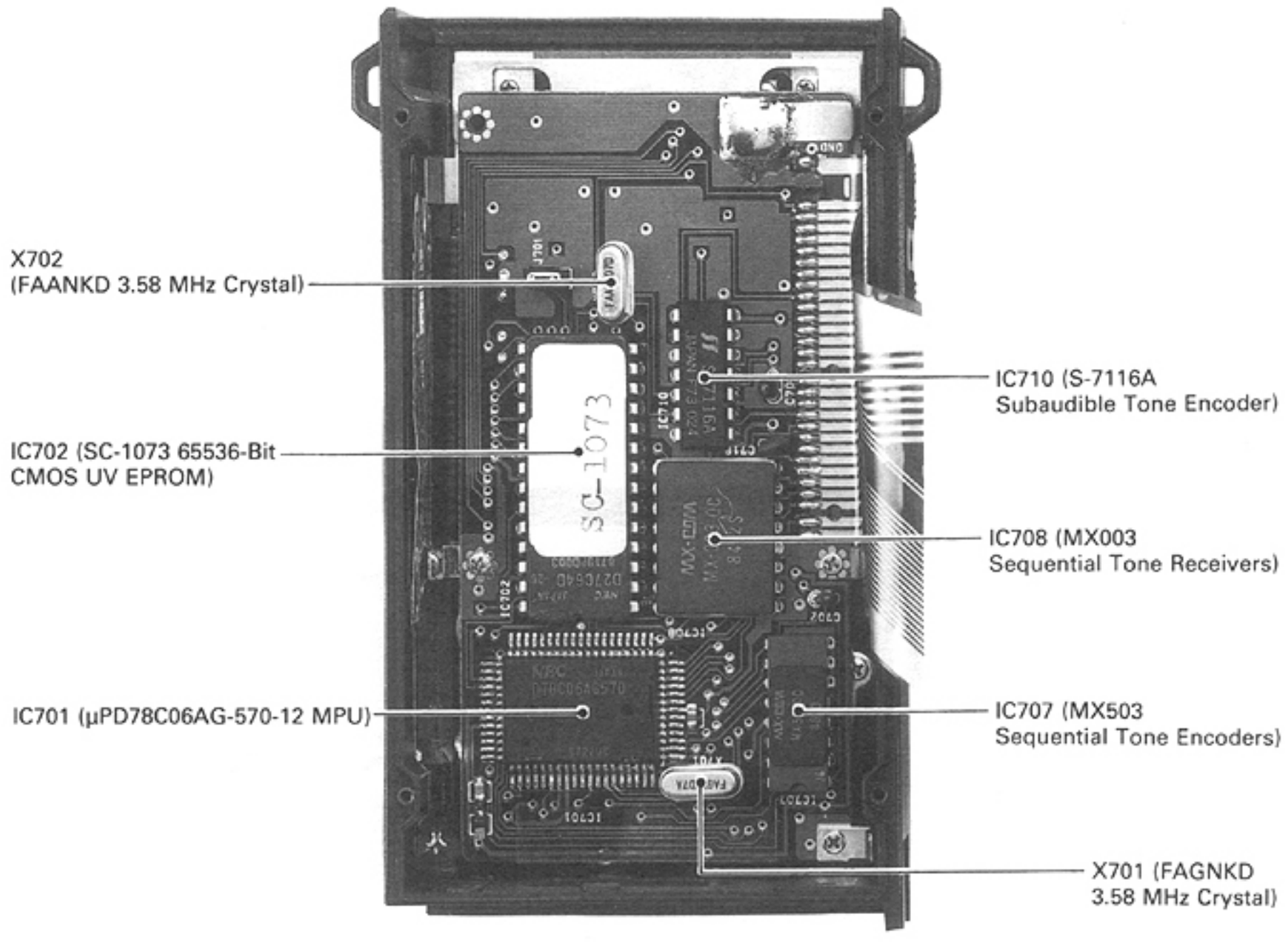


2 - 2 - 3 DISPLAY UNIT

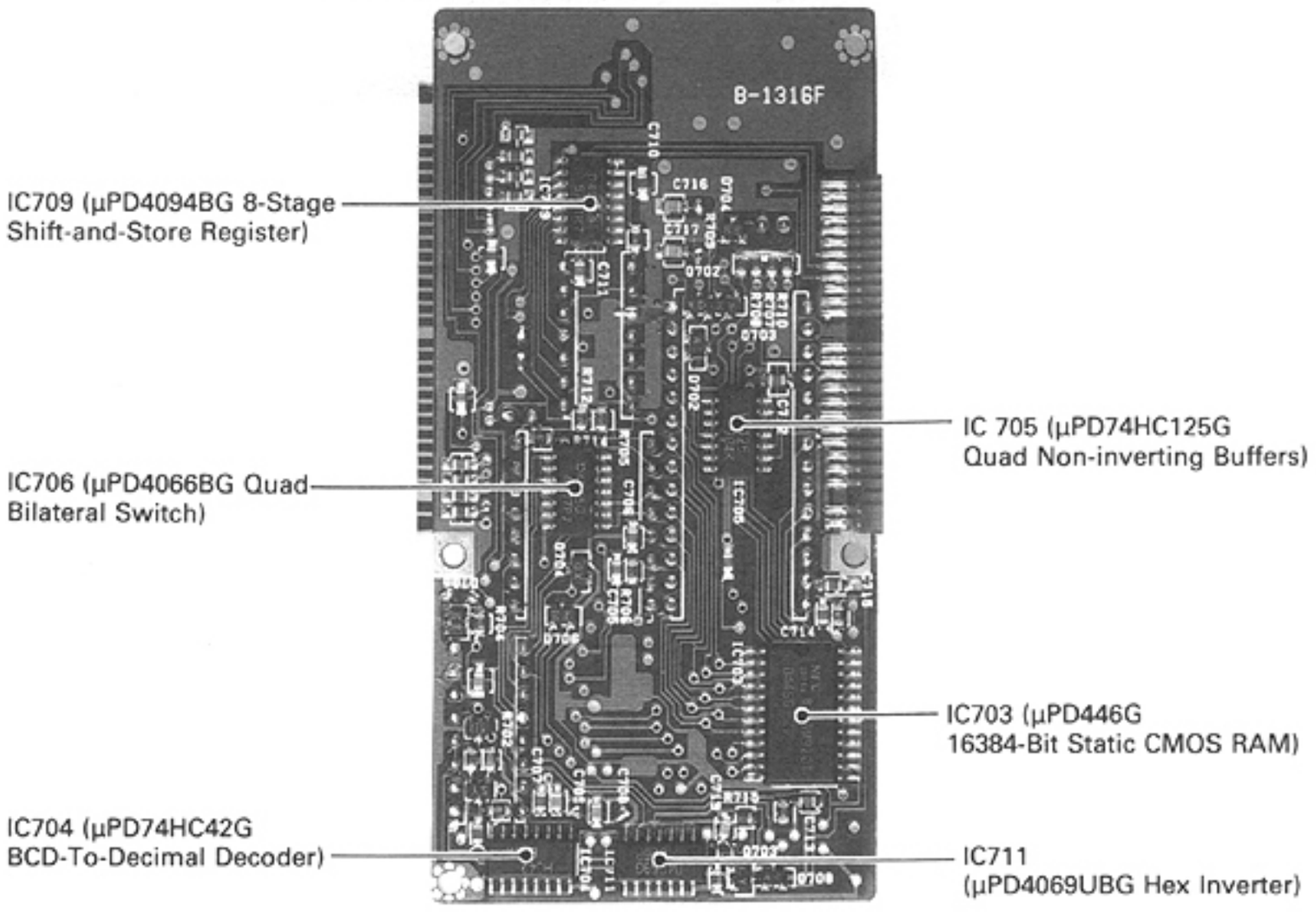


2 - 2 - 4 LOGIC UNIT (#01, #02, #03)

■ COMPONENT SIDE

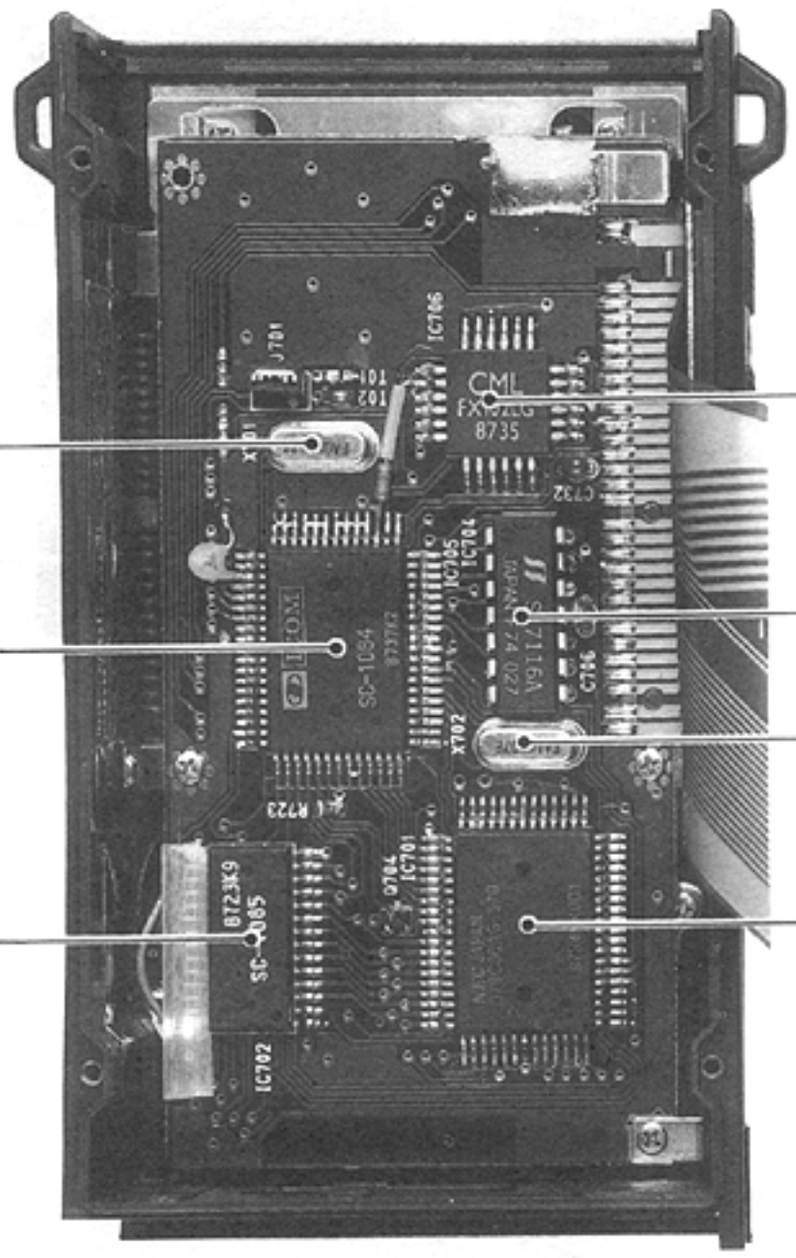


■ FOIL SIDE

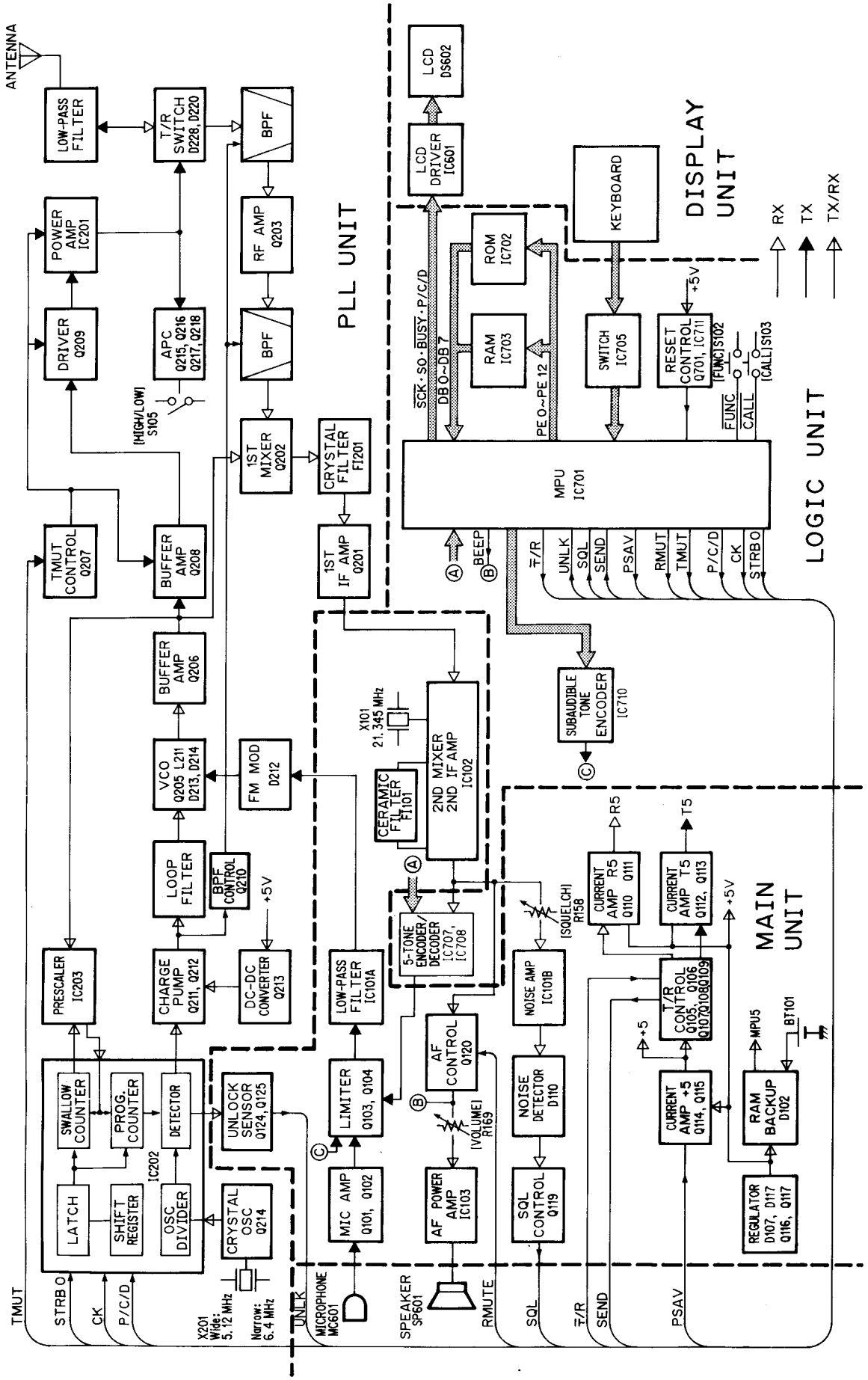


2 - 2 - 5 LOGIC-A UNIT (#11, #12, #13, #14, #15, #16, #17, #18, #19)

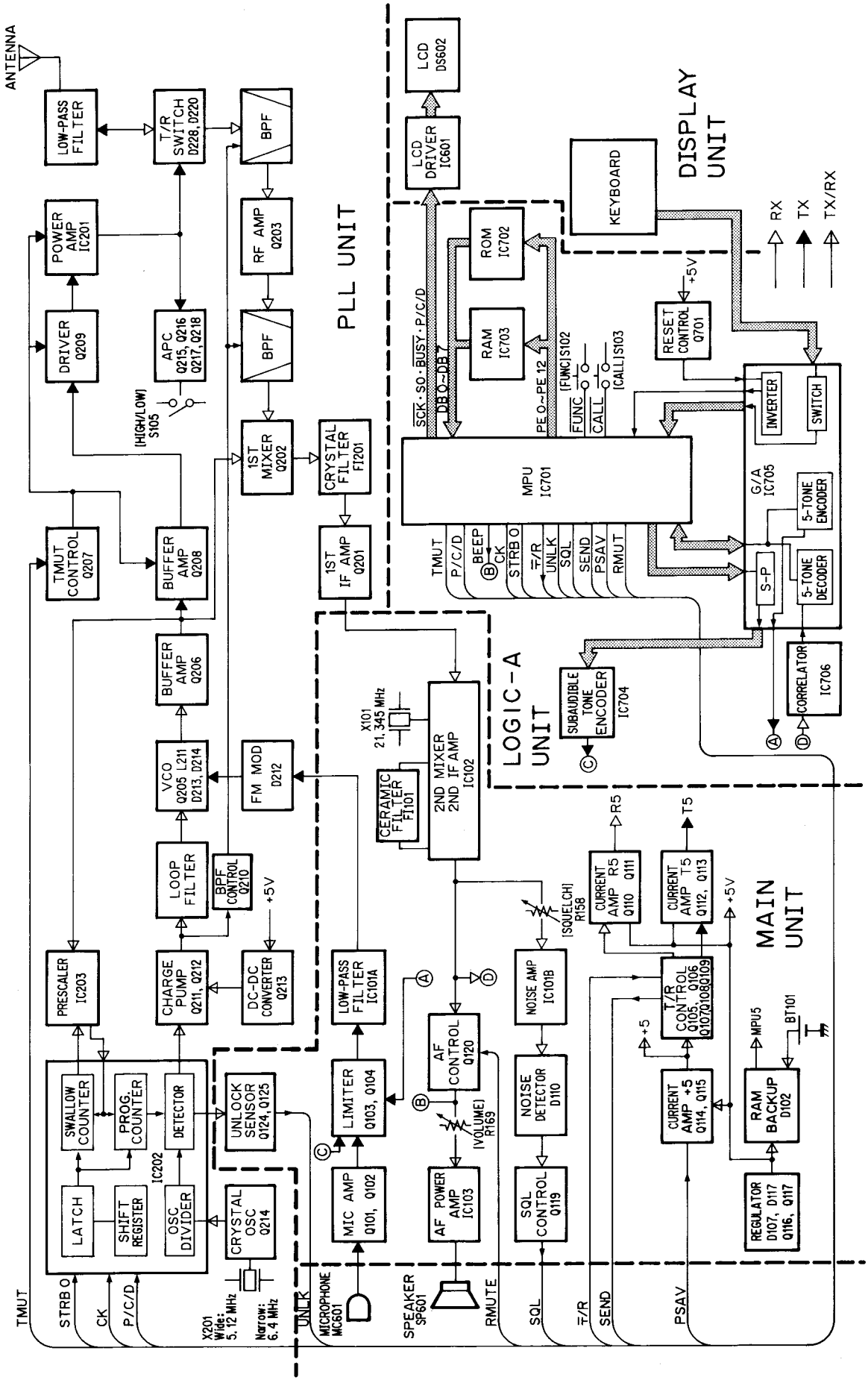
■ COMPONENT SIDE



■ VERSION #01~#03



■ VERSION #11~#19



4 - 1 RECEIVER CIRCUITS

4 - 1 - 1 ANTENNA SWITCHING CIRCUIT (PLL UNIT)

Receive signals enter the PLL UNIT from ANTENNA CONNECTOR J201 and pass through a Chebyschev low-pass filter consisting of C262~C266, L221 and L222. The antenna switching circuit employs a λ/4-type diode switching system which does not allow current to flow while receiving.

4 - 1 - 2 RF CIRCUIT (PLL UNIT)

The receive signals from the antenna switching circuit pass through a bandpass filter (L207, L208, C221, C225 and D208~D211). Signals which have been amplified at Q203 pass through the bandpass filter (L204~L206, C215, C218 and D202~D207). The center frequency of the bandpass filter is changed by voltage from the PLL circuit.

Signals are then applied to gate 1 of the 1st mixer (Q202) where, mixed with the 1st LO signal from the PLL circuit, they are converted to 21.8MHz 1st IF signals.

4 - 1 - 3 1ST LO CIRCUIT (PLL UNIT)

114.2~152.2MHz band signals from VCO Q205 are buffer amplified at Q206 and applied to transmit/receive switching circuit D215. The signals are then applied to gate 2 of 1st mixer Q202 as 1st LO signals.

4 - 1 - 4 IF CIRCUIT (PLL AND MAIN UNITS)

The 1st IF signals from Q202 pass through a pair of crystal filters (FI201) to suppress out-of-band signals and unwanted heterodyned frequency signals. The 1st IF signals are amplified at the IF amplifier (Q201) and pass through the matching coil (L201).

The signals, applied to pin 16 of IC102, are mixed with 2nd LO signals of 21.345MHz to convert 1st IF signals to 455kHz 2nd IF signals. X101 oscillates at 21.345MHz.

2nd IF signals are output from pin 3 and pass through the high quality ceramic filter (F1101) to suppress unwanted heterodyned frequency signals. The resulting signals are then amplified at the limiter amplifier section (pin 5 of IC102). Passing through the chip's quadrature detector, the signals are demodulated into AF with the output of the ceramic resonator (X102).

4 - 1 - 5 AF CIRCUIT (MAIN UNIT)

AF signal output from pin 9 on IC102 is applied to the base of Q118 as well as IC708 pin 14 in the LOGIC UNIT. R157 and C151 form the de-emphasis circuit. This de-emphasis circuit is an integrator circuit with frequency characteristics of −6dB/octave.

AF signals, amplified at Q118, are applied to the source of Q120. When the squelch circuit is activated, the RMUT signal from the MPU shuts off Q120, preventing AF signals from being output over the speaker. When the squelch is not activated, AF signals from Q120 are amplified at IC103. R169 adjusts speaker volume. IC103 drives the speaker to an AF output of more than 500mW with an 8Ω load.

4 - 1 - 6 SQUELCH CIRCUIT (MAIN UNIT)

Noise components from pin 9 of IC102 are applied to the high-pass filter IC101B through SQUELCH CONTROL R158. This active filter amplifies approximately noise components of 20kHz. The noise components are rectified by D110 and converted to DC voltage by R164, R165, C158 and C159. The DC voltage turns Q119 ON and OFF.

Output signals from Q119 are applied to MPU IC701 pin 15 in the LOGIC UNIT as a SQL signal. Signals from pin 30 of IC701 are then applied to Q120 as RMUT signals. Q120 switches the AF output signals.

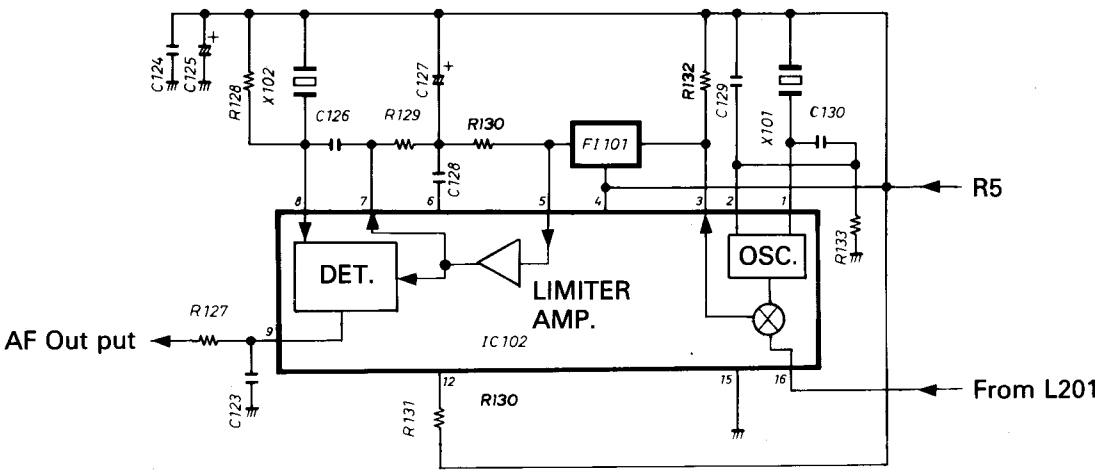


Fig. 4-1 IF Circuit

4 - 2 TRANSMITTER CIRCUITS

4 - 2 - 1 MICROPHONE AMPLIFIER CIRCUIT (MAIN UNIT)

AF signals from internal microphone MC601 or from EXTERNAL MIC JACK J202 are amplified at a limiter amplifier consisting of Q101~Q104.

This limiter amplifier is formed by a negative feedback circuit with frequency characteristics set at +6dB/octave in the 300Hz~3kHz range. This causes the limiter amplifier to function as a pre-emphasis circuit. Output from the limiter amplifier is similar to a rectangular waveform and includes harmonic components. Harmonic components higher than 3kHz are attenuated by splatter filter IC101A.

4 - 2 - 2 MODULATION CIRCUIT (PLL UNIT)

While the transceiver is transmitting, audio signals from the microphone are applied to the cathodes of D213 and D214 through the mic amp circuit. By applying audio signals to these diodes, its capacitance changes for performing frequency modulation (FM).

The frequency deviation is changed by R126 in the MAIN UNIT.

4 - 2 - 3 BUFFER AMPLIFIER CIRCUIT (PLL UNIT)

146~174MHz band signals output from Q205 are buffer amplified by Q206 and pass through transmit/receive switching circuit D216. They are amplified at predriver circuit Q208 and driver circuit Q209, thus obtaining signals of 20mW.

4 - 2 - 4 APC AND POWER SET CIRCUITS (PLL UNIT)

The antenna mismatching detector circuit consists of L218, C254~C259, D217 and D219. When the antenna impedance is matched at 50Ω, the voltage detected at D217 and D219 has a minimum value. However, when the antenna impedance is in a mismatched condition, the detected voltage becomes higher than it is when matched.

Q217 and Q218 form the differential amplifier circuit. The base bias of Q217 (reference voltage) is determined by R270, R271 and R274 (for HIGH output power) or R270~R274 (for LOW output power).

The voltage detected at D217 and D219 is combined by R239 and R238, and applied to the base of Q218.

When the antenna is mismatched with the transceiver, the base voltage of Q218 is higher than the base voltage of Q217. The Q216 collector current is then reduced, decreasing the Q215 and Q221 collector current. This decreases the output power of Q208 and Q209 until the base voltage of Q218 becomes the same as the base voltage of Q217.

When OUTPUT POWER SWITCH S105 is in the "HIGH" position, RF output power can be adjusted by R270. When S105 is "LOW" position, RF output power can then be adjusted by R273.

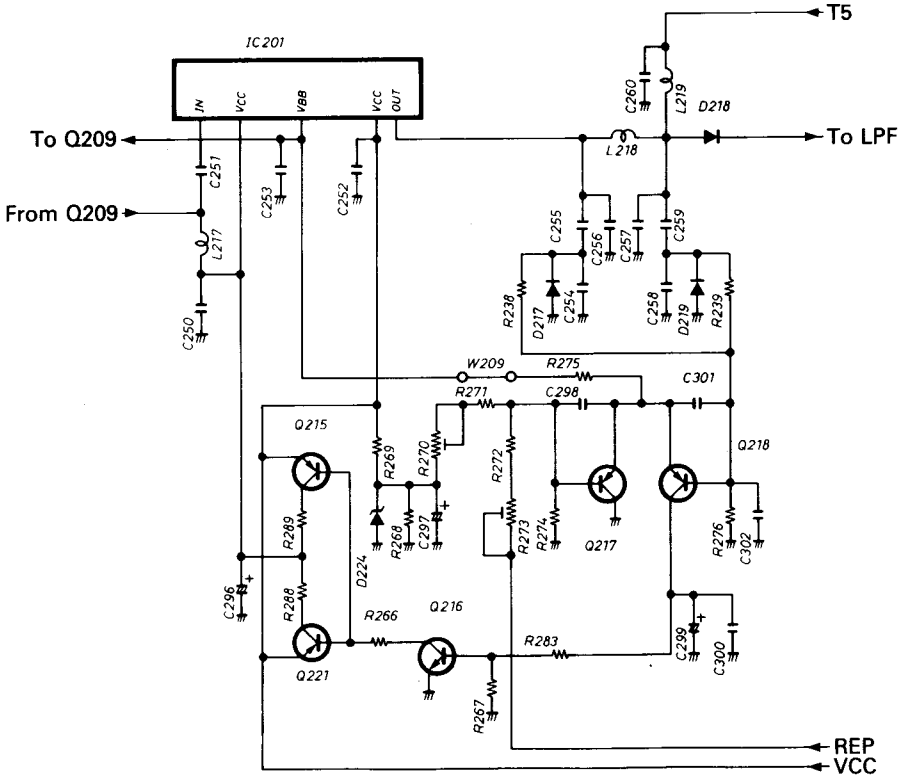


Fig. 4-2 APC and power circuit

4 - 2 - 5 POWER AMPLIFIER CIRCUIT (PLL UNIT)

Amplified signals at Q209 are power-amplified at IC201. IC201 is a small-sized power amplifier module giving stable output power of more than 5W with a driving power of only 20mW. The output power from IC201 passes through the APC circuit, the antenna switching circuit, a low-pass filter, and is then applied to the ANTENNA CONNECTOR J201.

Q207 shuts OFF the bias voltage of Q208, Q209 and IC201 to prevent unwanted emissions when switching from receive to transmit mode, or when the PLL circuit is unlocked.

4 - 2 - 6 ANTENNA SWITCHING CIRCUIT (PLL UNIT)

While transmitting, the antenna switching circuit (Q220, D218 and D220) is turned ON and L220 and C268 become parallel resonance circuits to prevent signals being applied to the receiver circuits.

4 - 3 PLL CIRCUITS

The PLL circuit adopts a dual modulus prescaler system. The circuit generates the desired frequency directly at the VCO circuit.

The PLL circuit consists of a PLL IC IC202 and prescaler IC203.

4 - 3 - 1 PLL CIRCUIT OUTLINE (PLL UNIT)

The PLL circuit is designed in a way that allows the desired frequency to be generated directly by the VCO circuit, adopting a dual modulus prescaler system.

Signals from the VCO circuit are buffer amplified at Q206 and divided N times at IC203. Signals are phase detected at IC202 and the detected signals are output from pin 12 and 13. The signal is applied to D213 and D214 in the VCO circuit through the loop filter.

N-data is the number of times the desired frequency is divided by the reference frequency. The desired frequency is the transmit frequency in transmit mode and the 1st LO frequency in receive mode.

$$N = \frac{\text{Desired frequency}}{\text{Reference frequency}}$$

Thus, the VCO outputs clean signals with a good C/N ratio and little spurious components because the PLL circuit is very simple, having no multiplier or mixer circuit.

4 - 3 - 2 REFERENCE FREQUENCY CIRCUIT (PLL UNIT)

A 5.12MHz (#01, 11, 14, 17, 18) or 6.4MHz (#02, 03, 12, 13, 15, 16, 19) signal is oscillated at reference oscillator Q214 and X201, and is applied to pin 17 of IC202. IC202 divides the frequency and a reference frequency of 5kHz (#01, 11, 14, 17, 18) or 12.5kHz (#02, 03, 12, 13, 15, 16, 19) is obtained.

4 - 3 - 3 LOOP FILTER CIRCUIT (PLL UNIT)

Pins 12 and 13 of IC202 output phase detected signals. These signals are applied to the charge pump consisting of Q211 and Q212 for converting to DC voltage. The DC voltage is then applied to the varicaps D213 and D214 through a lag-lead type loop filter consisting of R244, R245 and C277, for controlling the VCO output frequency.

4 - 3 - 4 VCO CIRCUIT (PLL UNIT)

Q205 employs a Colpitts oscillator circuit. The VCO free-run frequency is shifted by changing the capacitance.

In receive mode, Q204 and D212 are turned ON as the RS5 line becomes 5V. C234 is connected to D213 and D214 in parallel. Therefore, the VCO output frequency is shifted to a lower frequency than while transmitting.

In transmit mode, Q204 and D212 are turned OFF as the RS5 line becomes 0V. C234 is disconnected from the resonant circuit. Therefore, the VCO output frequency becomes higher than the receive mode.

Q206 functions as a buffer amplifier.

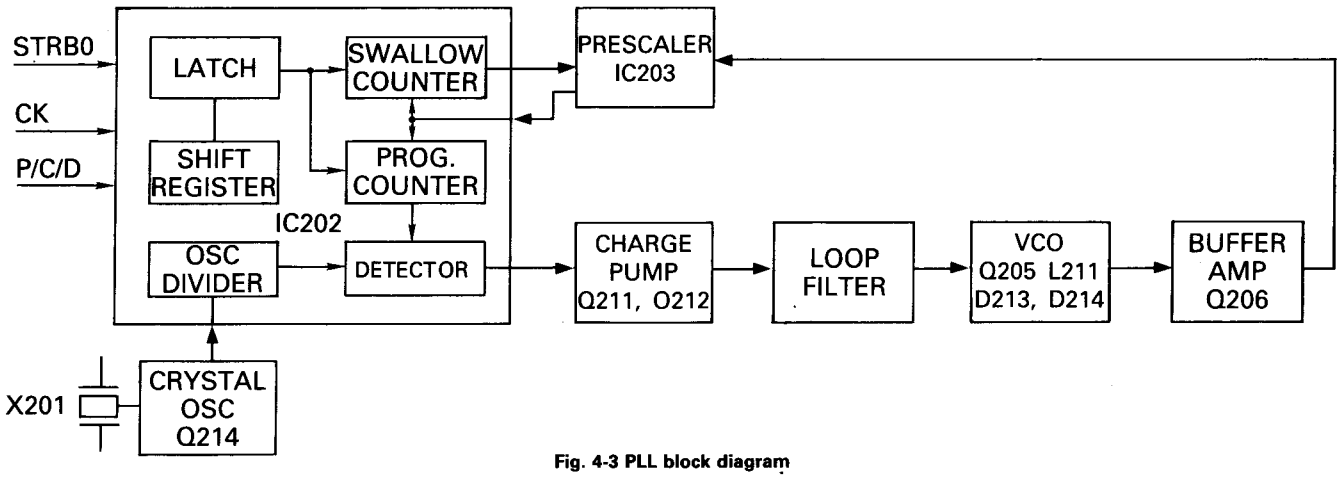


Fig. 4-3 PLL block diagram

4 - 4 LOGIC CIRCUITS

The logic circuit consists of an 8-bit CMOS MPU, 8k-word ROM, 2k-word RAM, 5-Tone encoder, 5-Tone decoder and subaudible tone encoder. The circuit controls frequency and tone setting and the FUNCTION DISPLAY, etc.

- **MPU PORT ALLOCATIONS**

PORT NUMBER	PIN NUMBER	DESCRIPTION
DB0~DB7	5~2 64~61	These are 8-bit data busses for an external ROM and RAM. DB0~DB3 are also used as matrix input ports.
PE0~PE15	43~57 59	These are 16-bit data busses. PE0~PE7 are used as matrix output ports. PE13~PE15 are used as matrix select signal ports for the RAM.
PA7 [$\overline{CS}$]	34	This port becomes "LOW" when IC701 outputs command or data signals to IC601.
PA6 [P/C/D]	33	This port outputs a selector signal for selecting the signal of PLL N-data and IC601 command/data.
PA5 [CK]	32	This port outputs a synchronizing signal when the PLL N-data is output.
PA4 [TMUT]	31	This port outputs a transmit mute signal. It becomes "HIGH" when no RF output power is required.
PA3 [RMUT]	30	This port outputs a receive mute signal. It becomes "HIGH" when no AF output power is required.
PA2 [PSAV]	29	This port outputs a power save control signal. It becomes "LOW" when the transceiver enters the power save mode.
PA1 [CPO]	28	This port outputs cloning data.
PA0 [STRB0]	27	This port outputs a latch signal for PLL data.
PB6 [STRB 2]	41	This port outputs a strobe signal for the CTCSS data.
PB5 [STRB1]	40	This ports outputs a strobe signal for the 5-Tone encoder.
PB4 [$\overline{T}$/R]	39	This port controls the switching of transmit/receive. It becomes "LOW" when the transceiver is in transmit mode.
PB0~PB3 [S0~S3]	38, 35, 36, 37	These are used as ports of the 5-Tone input/output data.
PC5 [$\overline{BUSY}$]	11	This port outputs the $\overline{BUSY}$ signal for IC601.

4 - 4 - 1 MPU (LOGIC UNIT)

MPU IC701 is μPD78C06AG. The following are the port allocations of each pin.

PORT NUMBER	PIN NUMBER	DESCRIPTION
PC4 [$\overline{FUNC}$]	12	This is an input port for the FUNCTION SWITCH. The transceiver enters the cloning receive mode when the port is "LOW" at turning the power ON.
PC3 [TRF]	13	This is an input port for the TRANSMIT INDICATOR. The indicator lights when the port becomes "LOW".
PC2 [SEND]	14	This is an input port for the transmit/receive switching signal. The port is also used as the cloning input.
PC1 [SQL]	15	This is an input port for the squelch open/close. It becomes "HIGH" when the squelch opens.
PC0 [UNLK]	16	This is an input port for the PLL unlock signal. It becomes "LOW" when the PLL is unlocked.
SO	21	This port outputs data for the subaudible tone and IC601.
$\overline{SCK}$	19	This port outputs a data timing signal of the S0 port. The S0 signal changes at the leading edge of the $\overline{SCK}$ output signal.
INT0	7	This is an input port for controlling the 5-Tone decoder IC. The 5-Tone decoder data is input when the port becomes "HIGH".
INT1	6	IC701 enters the standby mode when the port becomes "HIGH". This port becomes "HIGH" and "LOW" when the power is turned OFF and ON respectively.
TO	18	This port outputs signals for the beep sound.
$\overline{WR}$	9	This port becomes "LOW" when data is stored in the external RAM IC703.
$\overline{RD}$	10	This ports becomes "LOW" when data is recalled from the external ROM or RAM.
ϕout	60	This port outputs clock signals for controlling 5-Tone signals. The output frequency is 560kHz.

4 - 4 - 2 ROM (LOGIC UNIT)

ROM IC chip IC702 is an 8191-word, 8-bit CMOS ROM IC chip. The program in IC702 controls the IC701 MPU. The data reading is indicated by addresses PE0~PE12 of IC701, and done at the leading edge of the $\overline{RD}$ port signal.

4 - 4 - 3 RAM (LOGIC UNIT)

RAM IC chip IC703 is a 2048-word, 8-bit CMOS IC chip. IC703 stores data for channels, PLL N-data, tone numbers to the tone frequencies and shift frequencies etc. Data reading and writing are indicated by addresses PE0~PE10 of IC701, and done by timing signals $\overline{RD}$ and $\overline{WR}$.

4 - 4 - 4 RESET CIRCUIT (LOGIC UNIT)

The voltage of the +5V line rises up to 5V after the power is turned ON, and the collector of Q701 becomes 5V. When the collector of Q701 becomes "HIGH," pin 4 of IC711 becomes "LOW" then pin 6 of IC711 changes from "LOW" to "HIGH." The signal is applied to IC601 in the DISPLAY UNIT for resetting. The signal is also applied to IC701 through a delay circuit consisting of C702 and R704.
This action delays the MPU resetting slower than the LCD driver resetting.

When the power is turned OFF, pin 4 of IC711 changes from "LOW" to "HIGH." This voltage change is applied to IC701 for entering the MPU standby mode.

4 - 4 - 5 5-TONE ENCODER/DECODER CIRCUIT

- **FOR VERSIONS #01~#03 (LOGIC UNIT)**

IC707 is the 5-Tone encoder IC chip which generates 14 different tone signals. The 5-Tone data of D0~D3 are latched by the strobe signal at pin 40 of IC701 and the desired tone signal is output from pin 1 of IC707.

IC708 is a 5-Tone decoder IC chip and can detect 14 different tone signals. IC706 functions as an analog switch. Switches are turned ON in receive mode and the 5-Tone data are applied to IC701. If the detected tone signal is matched with the desired tone signal, D0~D3 ports output the data.

Clock signals for the 5-Tone encoder/decoder IC chips are applied from IC701.

- **FOR VERSIONS #11~#19 (LOGIC-A UNIT)**

IC705 is a gate array IC chip and consists of 5-Tone encoder, 5-Tone decoder data selectors for MPU control, serial/parallel converters, dividers and inverters.

PORT NUMBER	PIN NUMBER	DESCRIPTION
IO0~IO3	64~61	These are input/output ports for the 5-Tone encoder/decoder.
CON1	60	This port is used for selecting either the input or output ports of 100~103. It becomes "LOW" for output ports and "HIGH" for input ports.
RX	59	This port is used for selecting either the encoder or decoder function. It becomes "LOW" for encoding and "HIGH" for decoding.
TO1, TO2	44, 45	These ports select one of the 5-Tone sequential systems: CCIR, ZVEI, EEA or EIA.
ST1	57	This port inputs a strobe signal for the 5-Tone encoder/decoder.
EC, EC0~EC2	40~43	These ports output the 5-Tone encoder data.
DS	21	This port is used as an input port for 5-Tone signals.
ST3	8	This port outputs a strobe signal for the 5-Tone encoder/decoder.
SE1~SE3	2~4	This port is used as a data selector.
MA0~MA3 DB0~DB3 CE1, CE2	39~36 55~52 51, 50	Function of each port CE1, CE2 and DB0~DB3 is determined by data from ports SE1~SE3. Ports MA0~MA3 are allocated as data input.
ST2, SCK2, SI2	56, 6, 7	These are serial input ports for converting data from serial to parallel.
P1~P8	13~20	These are used as parallel output ports after data is converted from serial to parallel.
IN1, IN2	9, 11	These ports are connected to internal inverter inputs.
OUT1, OUT2	10, 12	These ports are connected to internal inverter outputs.
KO1	5	This port outputs 4.48MHz signals.
KO3	22	This port outputs 560kHz signals.
TEST, TI, SET, RES, CON2, RCE, RT2, RT1, CP1, DATC, KO5, KO4, KO2	23~25 28~33 46~49	These ports are used for checking the IC testing.

4 - 4 - 6 SELECTING A 5-TONE SEQUENTIAL (LOGIC-A UNIT)

One of 4 kinds of 5-Tone sequentials can be selected by the following method:
(Refer to Section 7 - 4 - 1.)

	TO1	TO2
EIA	L	L
CCIR	H	L
EEA	L	H
ZVEI	H	H

4 - 4 - 7 D/A CONVERTER CIRCUIT (LOGIC-A UNIT)

EC0~EC2 of IC701 outputs 5-Tone signals digitally. R713~R718 convert signal from digital to analog, and then output the signals as 5-Tones to the MAIN UNIT.

4 - 5 DISPLAY CIRCUIT (DISPLAY UNIT)

IC601 is a programmable LCD controller/driver IC chip. Data from the LOGIC UNIT are applied to IC601 and divided by 3 to be indicated on the FUNCTION DISPLAY.

4 - 6 POWER SUPPLY CIRCUITS

4 - 6 - 1 INTERNAL/EXTERNAL POWER SWITCHING CIRCUIT (MAIN UNIT)

When using an attached battery pack, relay RL101 is OFF and ON-OFF/VOLUME CONTROL R169 is connected to the battery pack. When a power source with voltage between 12V~15V is connected to EXTERNAL DC POWER JACK J204, RL101 is ON and R169 is connected to the external power source.

In case J204 is incorrectly connected (reverse polarity), D109 is reversely biased, preventing RL101 from being ON and protecting the other circuits.

4 - 6 - 2 +5V LINE REGULATOR CIRCUIT (MAIN UNIT)

A voltage regulator circuit consisting of Q116, Q117 and D107 keeps the output voltage at 5V constantly even when the input voltage is changed from 12V to 15V.

Q116 and Q117 are connected in a complementary circuit for a higher current amplification factor.

Also, the collector voltage of Q129 is approximately 5V. As the temperature coefficient of the junction voltage of D108 is nearly equal to the V_{BE} of Q116, the output voltage is kept constant against any change in temperature.

4 - 6 - 3 +5 LINE REGULATOR CIRCUIT (MAIN UNIT)

Q114 and Q115 are connected in a complementary circuit for a higher current amplification factor. So, the output voltage is kept constant against any change in temperature.

When the transceiver enters the power saver mode, pin 29 of IC701 becomes "LOW" intermittently. Therefore, Q114 is turned ON and OFF repeatedly and the +5 line is controlled by a signal of pin 29.

4 - 6 - 4 POWER SUPPLY FOR EXTERNAL UNIT (PLL UNIT)

This power supply is especially used for an optional HS-10SA VOX UNIT. Q219 applies 5V and up to 5mA current to the EXTERNAL MIC JACK.

When a load to the circuit is light, a voltage drop at R279 is low and the collector of Q219 outputs 5V. When the current is overloaded, Q219 reduces the current until the base voltage of Q219 plus V_{BE} and the emitter voltage of Q219 are the same

4 - 6 - 5 POWER SUPPLY FOR RAM (MAIN UNIT)

When the transceiver is turned ON, 5V is applied from the +5V line to the RAM IC IC703 through D101 and the MPU5 line. This is because the voltage at the cathode of D102 is higher than the voltage of BT101 (3V).

When R169 is turned OFF, the +5V line becomes 0V. 3V of BT101 is applied to pin 24 of IC703.

SECTION 5 MECHANICAL PARTS AND DISASSEMBLY

5 - 1 CASE DISASSEMBLY

1. Turn power OFF and remove the battery pack.
2. Remove screw Ⓐ, 4 screws Ⓑ on the rear panel and 4 screws Ⓒ on the bottom as shown in Fig. 5-1-1.

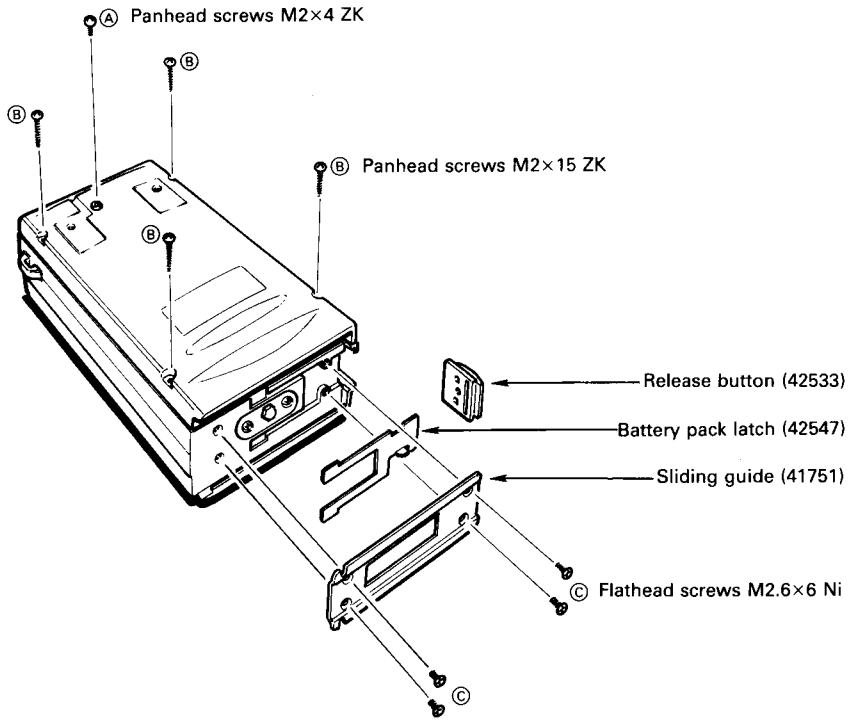


Fig. 5-1-1

3. Remove the rear panel as shown in Fig. 5-1-2.

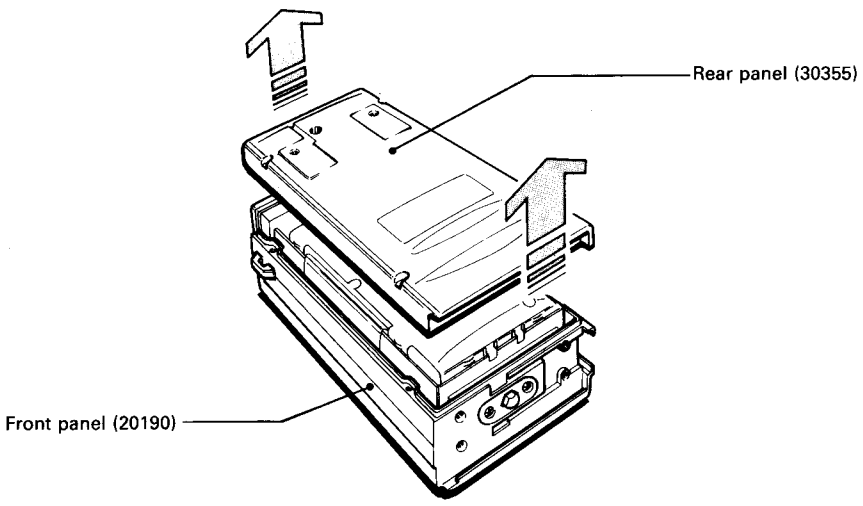


Fig. 5-1-2

4. Slide the inner frame upward slightly as shown in Fig. 5-1-3, and lift the frame away from the front panel.
CAUTION: Be careful not to damage the flexible board.

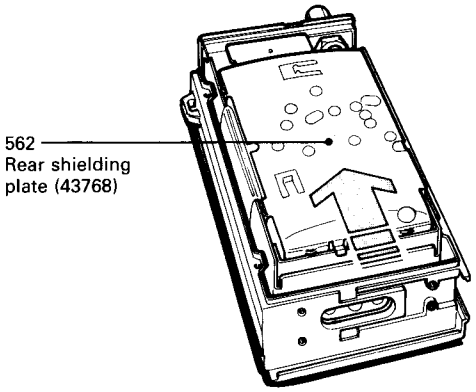


Fig. 5-1-3

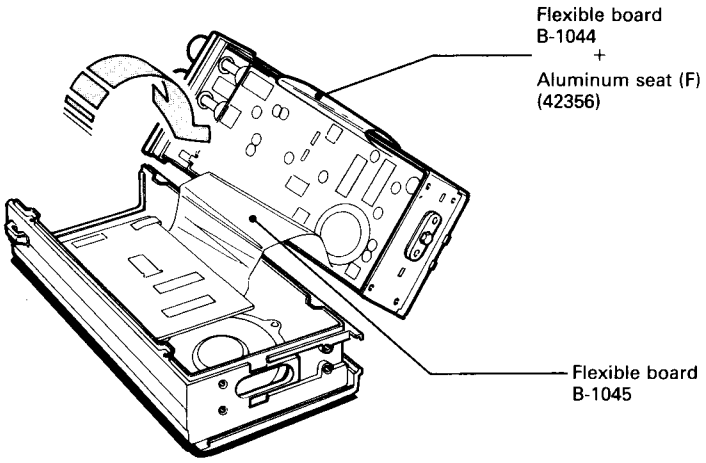


Fig. 5-1-4

5. Remove the 2 knobs on the top panel (VOLUME and SQUELCH) and push IN the [LIGHT] and [HIGH/LOW] SWITCHES. Remove the 4 screws on the sides of the chassis, and open the chassis as shown in Fig. 5-1-7.

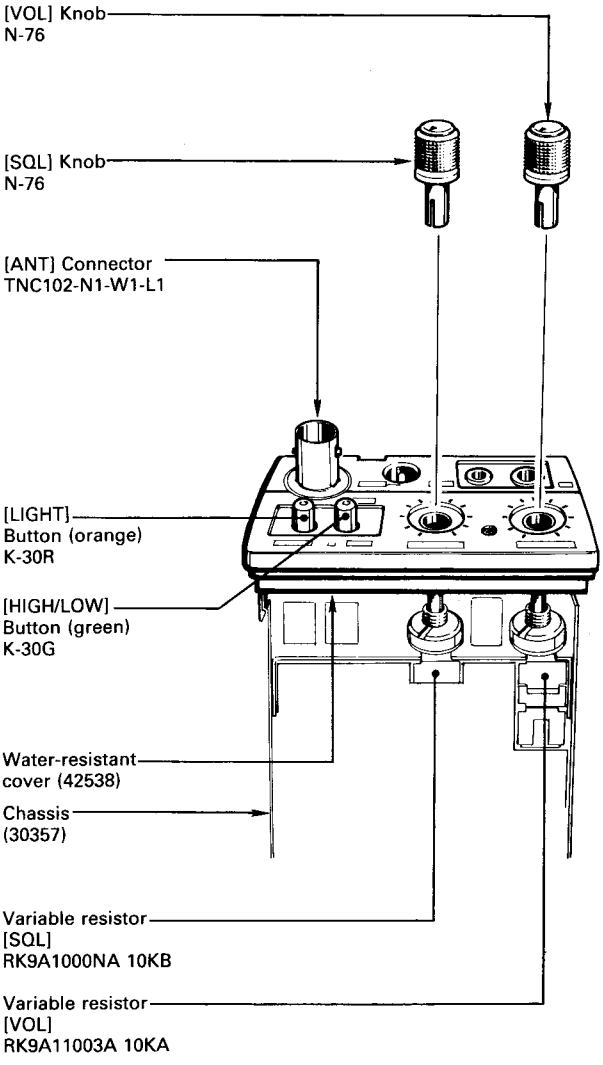


Fig. 5-1-5

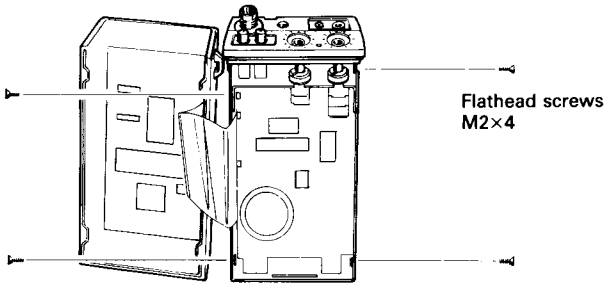


Fig. 5-1-6

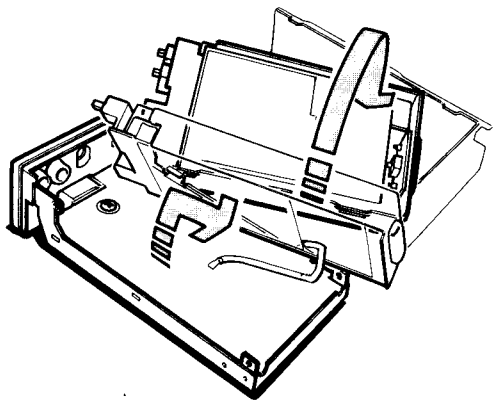


Fig. 5-1-7

5 - 2 TOP PANEL DISASSEMBLY

1. Remove screw Ⓐ.

2. Remove the TNC nut and the TNC washer.

3. Remove the antenna connector by unsoldering point Ⓑ on the components side and point Ⓒ on the foil side of the PLL UNIT.

4. Remove the top panel by slightly prying outward both side tabs (points Ⓓ) on the top panel.
   See Fig. 5-2-3 below. CAUTION: Be careful not to break the tabs.

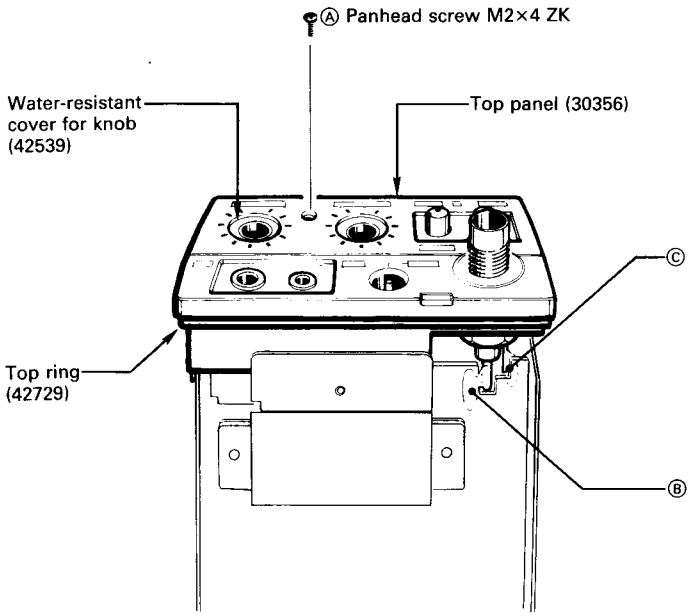


Fig. 5-2-1

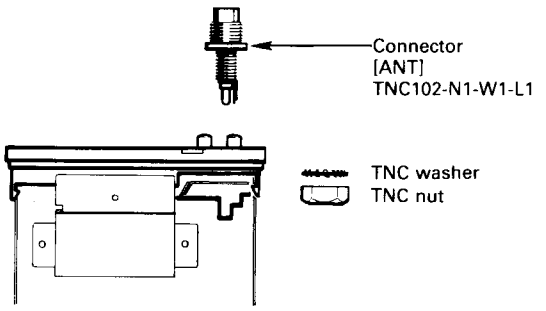


Fig. 5-2-2

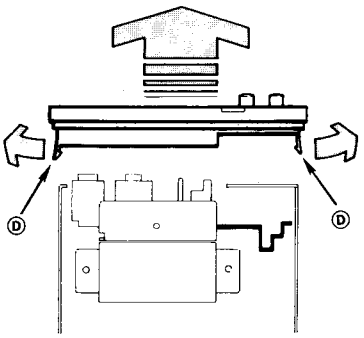


Fig. 5-2-3

5 - 3 PA AND EXTERNAL JACK DISASSEMBLY

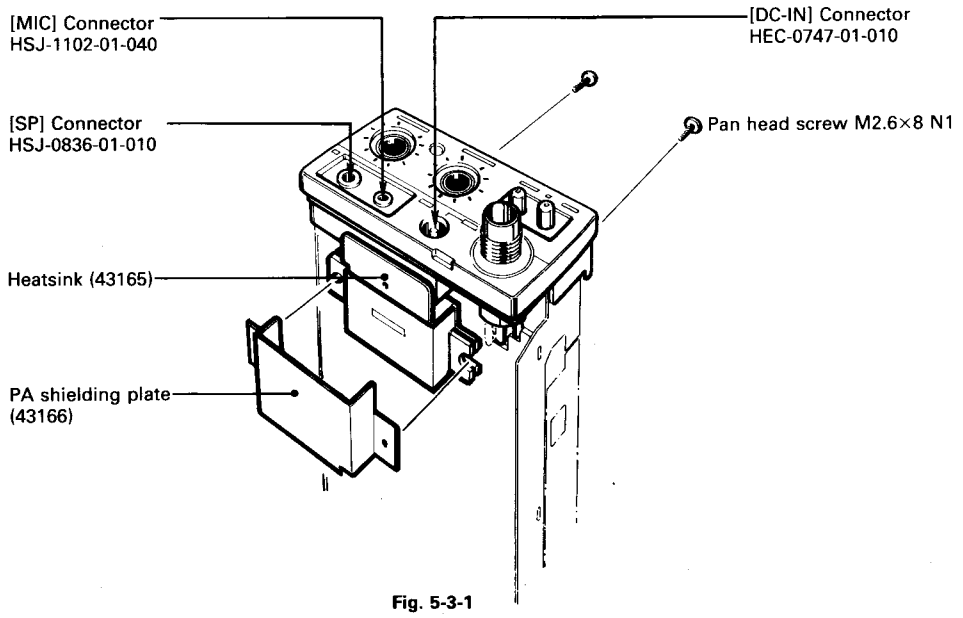


Fig. 5-3-1

5 - 4 SPEAKER AND MICROPHONE DISASSEMBLY

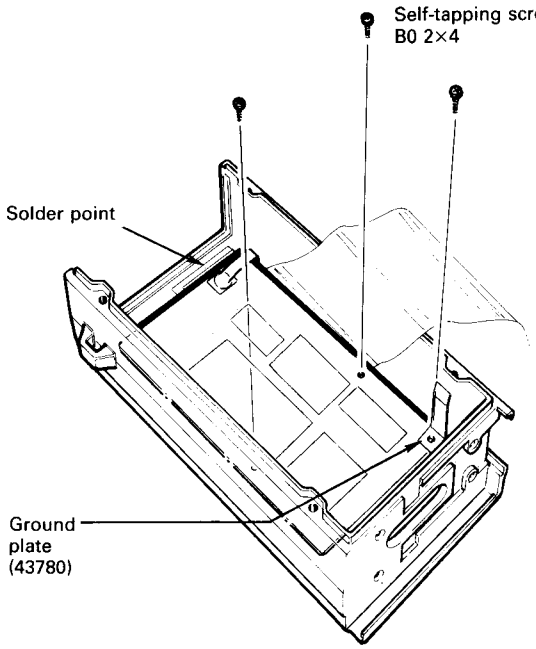


Fig. 5-4-1

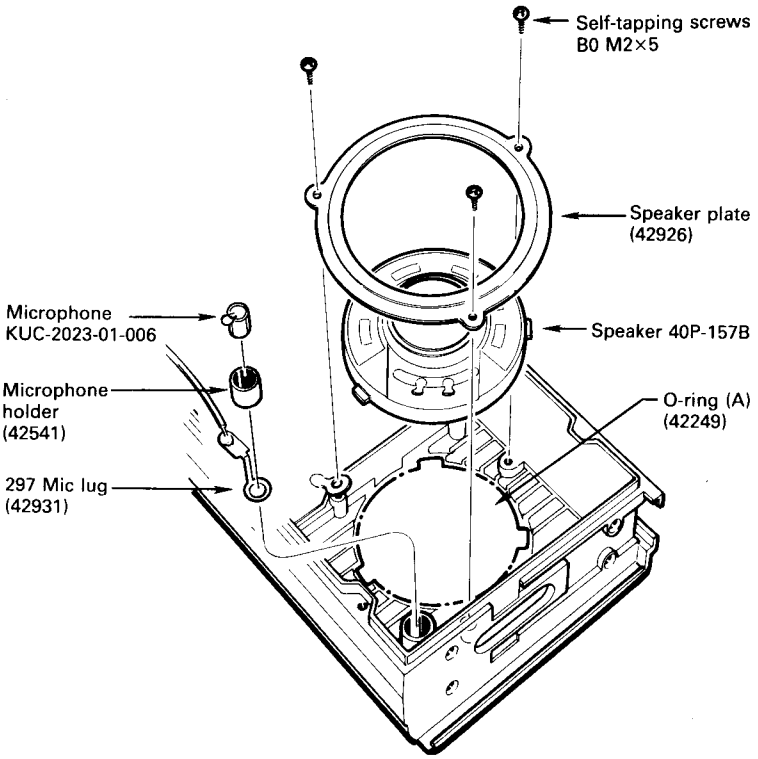


Fig. 5-4-2

5 - 5 DISPLAY UNIT AND LCD DISASSEMBLY

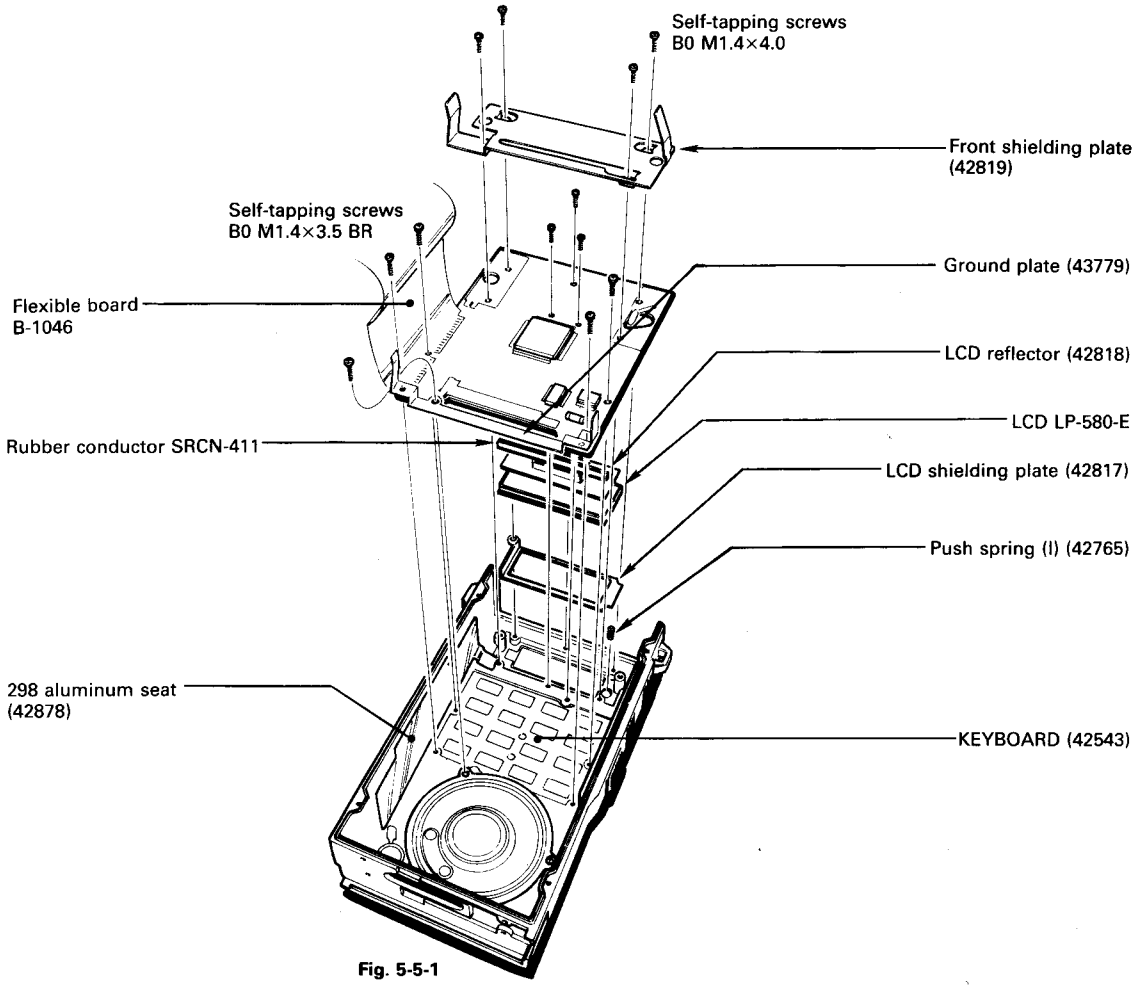


Fig. 5-5-1

5 - 6 PTT SPRING DISASSEMBLY

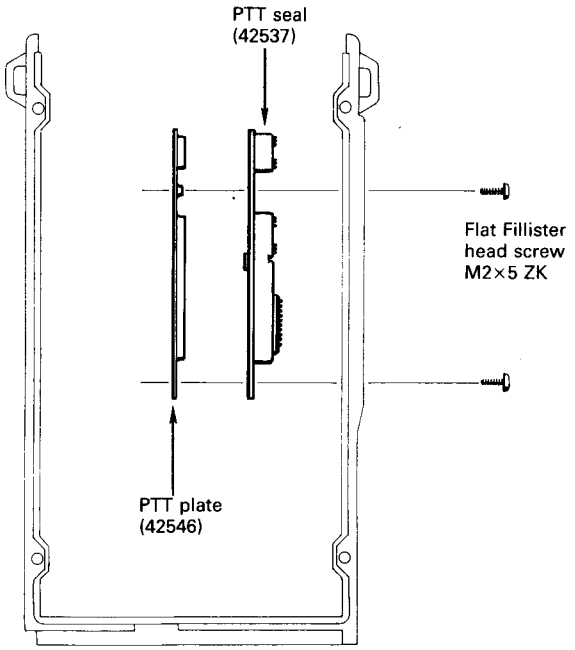


Fig. 5-6-1

5 - 7 UNIT BOTTOM DISASSEMBLY

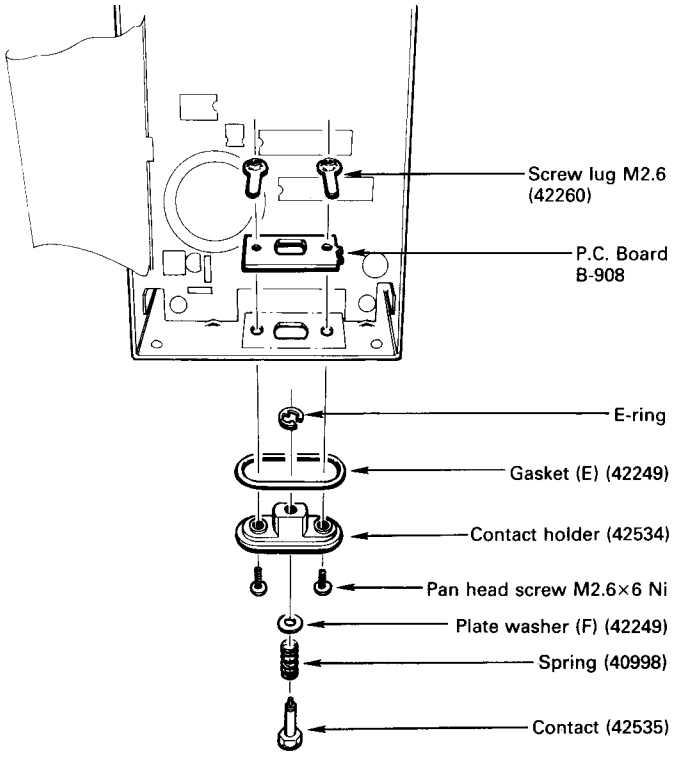


Fig. 5-7-1

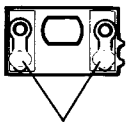


Fig. 5-7-2

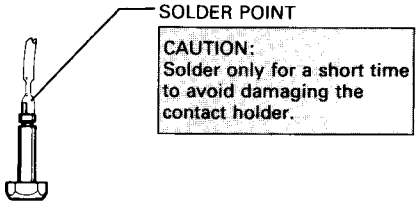


Fig. 5-7-3

6 - 1 BASIC PROGRAMMING

The transceiver MUST BE switched from OPERATING MODE to PROGRAMMING MODE before any programming can be performed.

Observe the following instructions to activate PROGRAMMING MODE:

1) Remove the front and rear covers of the transceiver.

2) Unplug P701 on the LOGIC UNIT. (Fig. 6-1)

3) Turn power to the transceiver ON. PROGRAMMING MODE is now activated.

NOTE: To prevent additional programming from the user side of the transceiver DO NOT forget to re-plug P701 on the LOGIC UNIT.
Note the original data stored before programming, then store the original data correctly again after making adjustments.

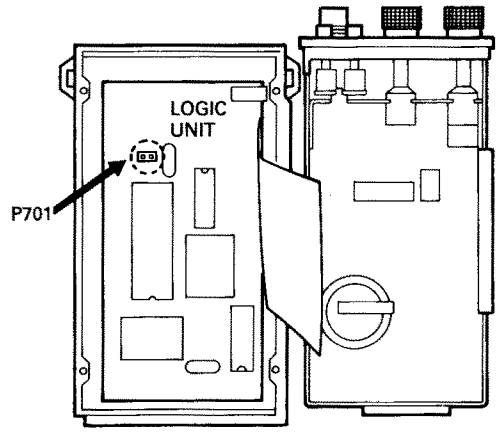


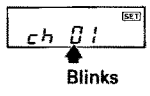
Fig. 6-1

These are set mode examples required for adjustments. Repeatedly push [TONE] to sequentially move through each example.
Refer to the PROGRAMMING MANUAL for more programming information.

SET MODE [1]

[SET] [1]

Push [SET] and then push [1].



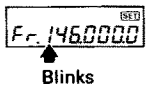
MEMORY CHANNEL Setting memory channel 16 .

Push keys [1] [6] (Blinks) [SET]

Display ch 16 ch 16 (Blinks)

[TONE]

Push [TONE] 2 times.



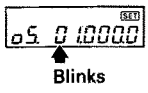
OPERATING FREQUENCY Setting frequency 147.000MHz.

Push keys [1] [4] [7] [0] [0] [0] [0] (Blinks) [SET]

Display Fr 147.0000 (Blinks) Fr 147.0000 Fr 147.0000 (Blinks)

[TONE]

Push [TONE] 1 times.



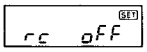
OFFSET FREQUENCY
If offset frequency appears, push [SET].

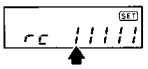
Display oS oFF

[TONE]

Push [TONE] 1 times.

REPEATER CODE
If repeater code appears, push [SET].

Display 

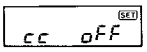


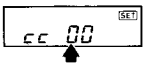
Blinks

[TONE]

Push [TONE] 1 time.

SUBAUDIBLE TONE
Set subaudible tone or turn OFF.
Push [SET].

Display 

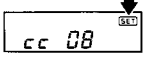


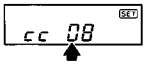
Blinks

Setting subaudible tone 88.5Hz (Tone No. 08).

Push keys [0] [8]
Blinks

[SET]

Display 

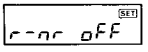


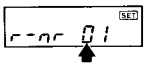
Blinks

[TONE]

Push [TONE] 3 times.

RECEIVER ACCESS NUMBER
If receiver access number appears, push [SET].

Display 

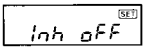


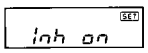
Blinks

[TONE]

Push [TONE] 1 time.

TRANSMIT INHIBIT
If transmit inhibit is ON, push [SET].

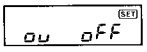
Display 

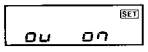


[TONE]

Push [TONE] 1 time.

TIME-OUT TIMER
If time-out timer is ON, push [SET].
Turning time-out timer OFF.

Display 



[RESET]

Push [RESET] 1 time.

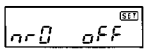
Return to OPERATING MODE.

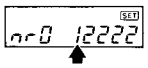
SET MODE [2]

SET 2

Push SET and then push 2.

TRANSMIT 5-TONE CODE
If transmit 5-Tone code appears, push SET.

Display 



RESET

Push RESET 1 time.

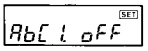
Return to OPERATING MODE.

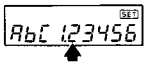
SET MODE [5]

SET 5

Push SET and then push 5.

ANSWER BACK 1
If answer back 1 tone code appears, push SET.

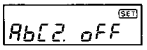
Display 

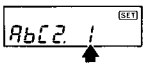


G

Push G 1 time.

ANSWER BACK 2
If answer back 2 tone code appears, push SET.

Display 

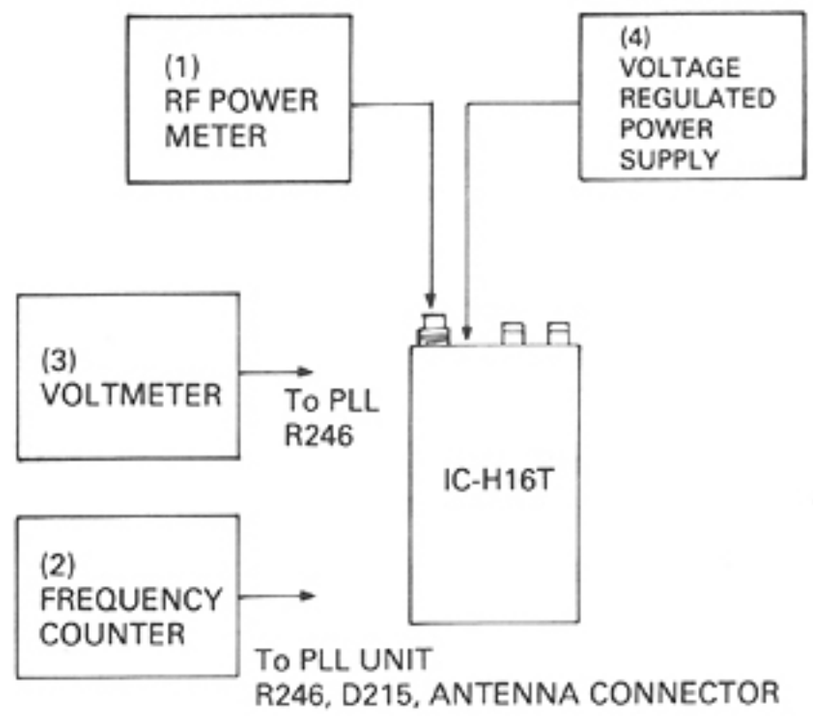


RESET

Push RESET 1 time.

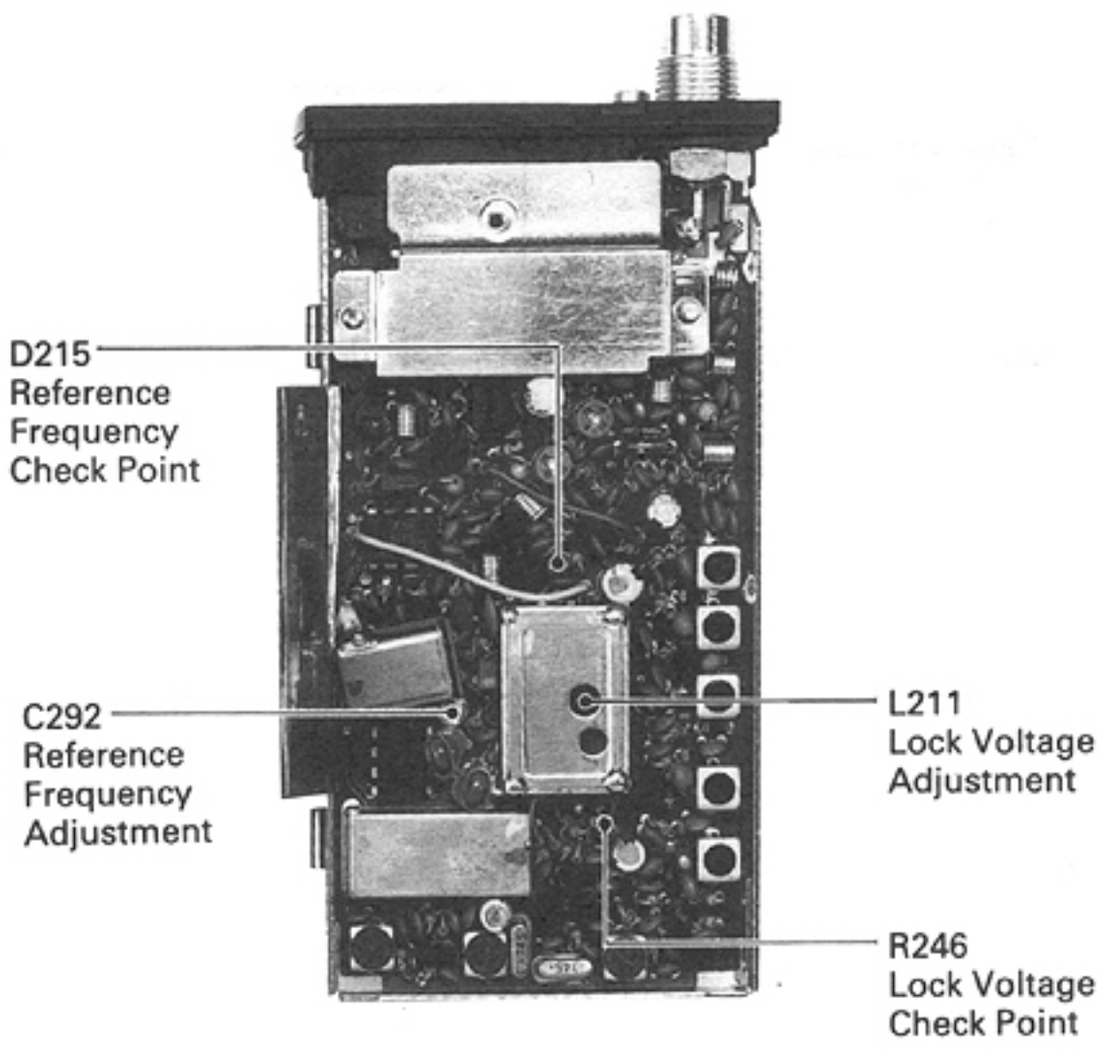
Return to OPERATING MODE.

6 - 2 PLL ADJUSTMENT

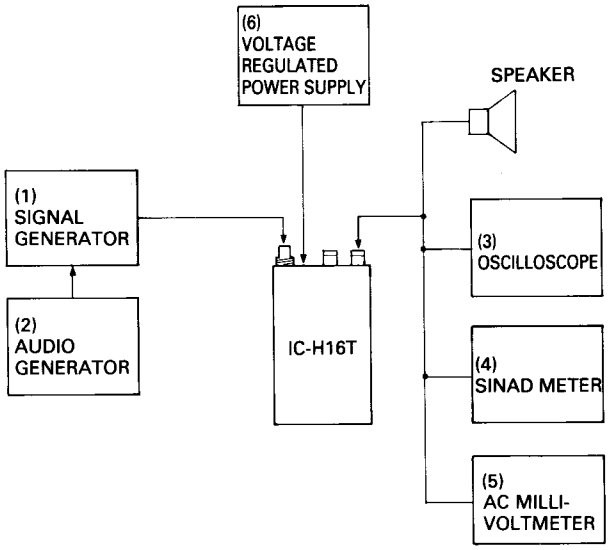
TEST INSTRUMENTS REQUIRED	MEASUREMENT CONNECTION LOCATION
(1) RF POWER METER (TERMINATED TYPE) • Measuring range : 0~10W • Frequency minimum : At least 180MHz • Impedance : 50Ω • SWR : Less than 1:1.2 (2) FREQUENCY COUNTER • Frequency minimum : At least 180MHz • Accuracy : Better than ±1ppm • Sensitivity : 100mV or better (3) VOLTMETER • Input impedance : 50kΩ DC or better (4) VOLTAGE REGULATED POWER SUPPLY • Output voltage : 13.2V DC • Current capacity : 2A	

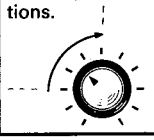
ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
LOCK VOLTAGE	1	• Operating frequency: 173.900MHz • Receive mode	PLL	Connect the voltmeter to R246.	15.0V	PLL	L211
	2	• Transmit mode			16.0V		L211
	3	• Operating frequency: 146.000MHz • Receive mode			3.8~16.0V		Verify. If less than 3.8V, adjust L211.
REFERENCE FREQUENCY	1	• Operating frequency: 146.000MHz • Receive mode	PLL	Connect the frequency counter to D215.	124.200MHz	PLL	C292
	2	• OUTPUT POWER SWITCH: LOW • Transmit mode			146.000MHz ±200Hz		Verify

PLL UNIT

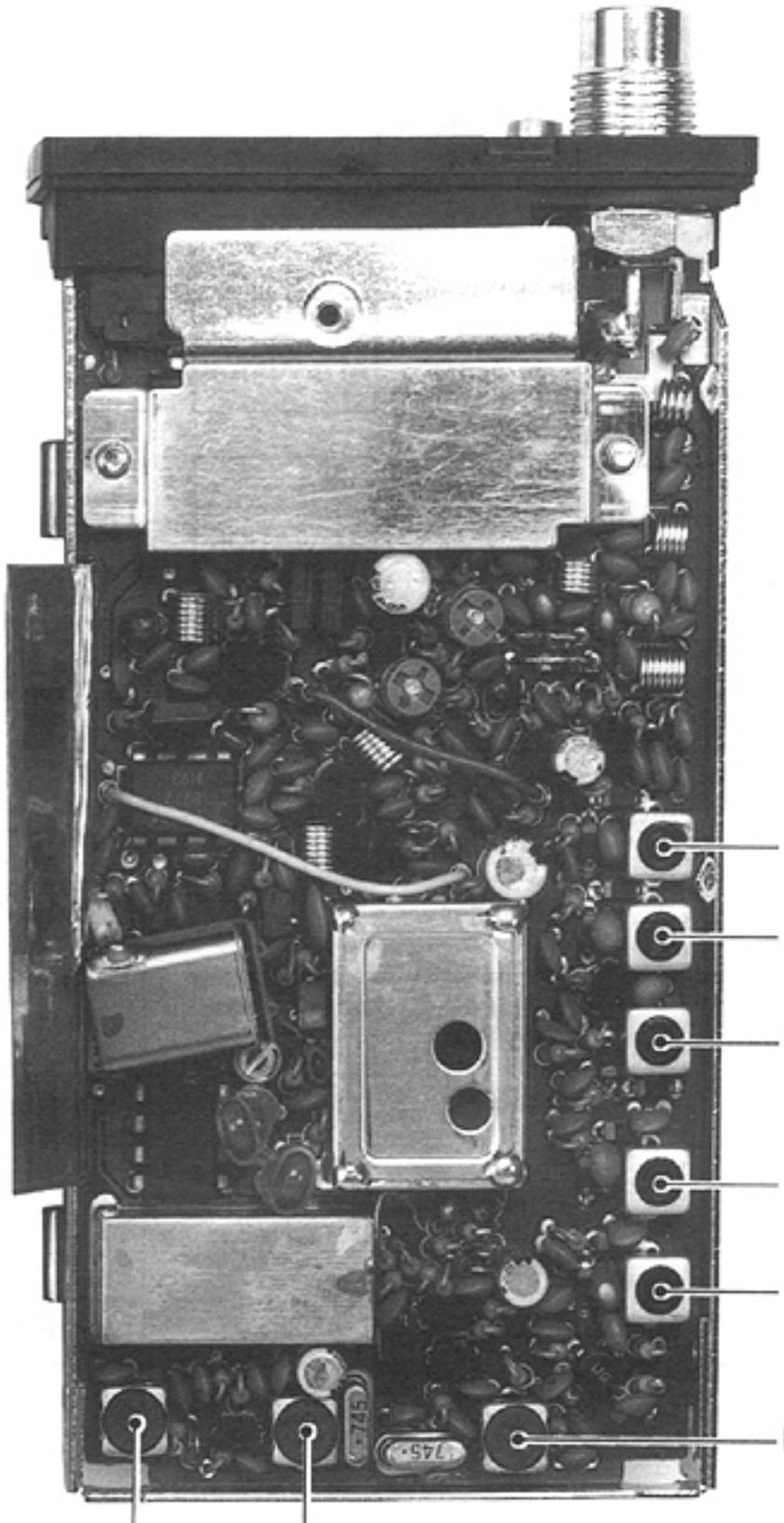


6 - 3 RECEIVER ADJUSTMENT

TEST INSTRUMENTS REQUIRED	MEASUREMENT CONNECTION LOCATION
(1) SIGNAL GENERATOR • Frequency range : 130~180MHz • Output level : 0.1μV~3.2mV (2) AUDIO GENERATOR • Frequency range : 50~3000Hz • Output level : 0~200mV • Distortion : Less than 0.1% (3) OSCILLOSCOPE • Frequency range : DC~20MHz • Measuring range : 0.01~10V (4) SINAD METER (5) AC MILLI-VOLTMETER • Measuring range : 10mV~10V (6) VOLTAGE REGULATED POWER SUPPLY • Output voltage : 13.2V DC • Current capacity : 2A	

ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
SENSITIVITY		CAUTION: The answer back function must be turned OFF to protect a signal generator from answer back signal output. See p.18 in the IC-H16T PROGRAMMING MANUAL for details. Push key [RESET] before receiver adjustment.					
	1	• Operating frequency: 160.200MHz • Receive mode • SQUELCH CONTROL: Max. counter-clockwise • Apply an RF signal to the ANTENNA CONNECTOR. Level: 0.35μV Dev. : ±3.5kHz (#01, #11, #14, #17, #18) ±1.75kHz (#02, #03, #12, #13, #15, #16, #19) Mod.: 1kHz	TOP PANEL	Connect a SINAD meter to the EXTERNAL SPEAKER JACK. Use an 8Ω speaker.	Minimum distortion level. Verify that the sensitivity is less than 0.35μV for 12dB SINAD.	PLL	L201~L208
		Note: Repeat the above adjustment several times until the measured value is at minimum.					
AF OUTPUT	1	• Operating frequency: 160.200MHz • Receive mode • Apply an RF signal to the ANTENNA CONNECTOR. Level: 1mV Dev. : ±3.5kHz (#01, #11, #14, #17, #18) ±1.75kHz (#02, #03, #12, #13, #15, #16, #19) Mod.: 1kHz	TOP PANEL	Connect the AC milli-voltmeter and distortion meter to the EXTERNAL SPEAKER JACK. Use an 8Ω speaker.	More than 2.0Vrms at 10% distortion.		Verify
SQUELCH SENSITIVITY	1	• Apply no RF signal to the ANTENNA CONNECTOR. • SQUELCH CONTROL: Threshold point.	TOP PANEL	Speaker.	Threshold point is between the 9 o'clock and 12 o'clock positions. 		Verify

PLL UNIT


L208
L207
L206
L205
L204
L203
L202
L201
Sensitivity Adjustment

6 - 4 TRANSMITTER ADJUSTMENT

TEST INSTRUMENTS REQUIRED

(1) RF POWER METER (TERMINATED TYPE)
- Measuring range : 0~10W
- Frequency range : At least 180MHz
- Impedance : 50Ω
- SWR : Less than 1:1.2

(2) FM DEVIATION METER
- Frequency minimum : At least 180MHz
- Measuring range : 0~±10kHz

(3) ATTENUATOR
- Input power : At least 5W
- Attenuation : 30dB or 40dB

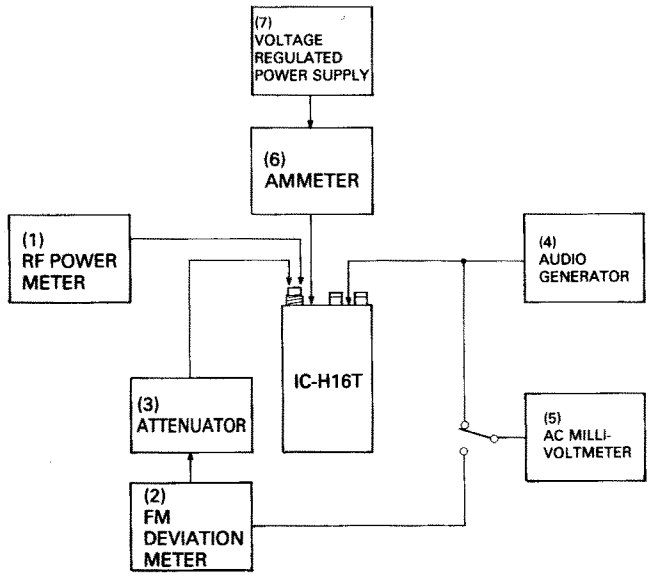
(4) AUDIO GENERATOR
- Output frequency : 50~3000Hz
- Output level : 0~200mV
- Distortion : Less than 0.1%

(5) AC MILLI-VOLTMETER
- Measuring range : 10mV~2V

(6) AMMETER
- Measuring range : 0~2A

(7) VOLTAGE REGULATED POWER SUPPLY
- Output voltage : 13.2V DC
- Current capacity : 2A

MEASUREMENT CONNECTION LOCATION



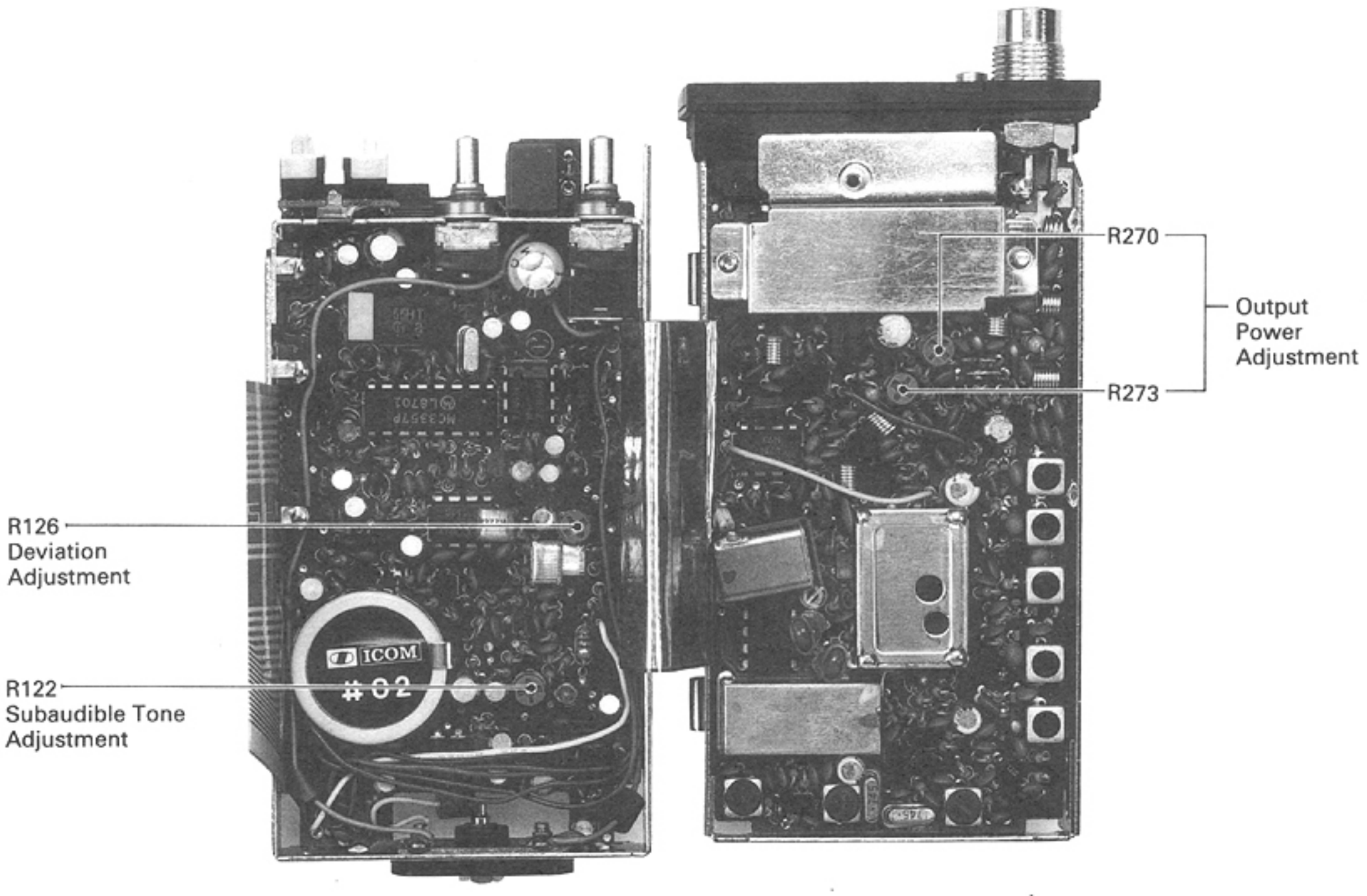
ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
OUTPUT POWER	1	• Operating frequency: 160.000MHz • OUTPUT POWER SWITCH: HIGH • Transmit mode	TOP PANEL	Connect the RF power meter to the ANTENNA CONNECTOR.	5.0W	PLL	R270
	2			Ammeter	Less than 1.5A		Verify
	3	• OUTPUT POWER SWITCH: LOW • Transmit mode		Connect the RF power meter to the ANTENNA CONNECTOR.	750mW		R273
	4			Ammeter	Less than 750mA		Verify
	5	• Operating frequency: 146.000MHz and 173.900MHz • OUTPUT POWER SWITCH: HIGH		Connect the RF power meter to the ANTENNA CONNECTOR.	4.5~5.5W		
	6			Ammeter	Less than 1.5A		
	7	• Operating frequency: 146.000MHz and 173.900MHz • OUTPUT POWER SWITCH: LOW		Connect the RF power meter to the ANTENNA CONNECTOR.	0.5~1.0W		
	8			Ammeter	Less than 750mA		
DEVIATION	1	• Operating frequency: 173.900MHz • OUTPUT POWER SWITCH: HIGH • Apply an AF signal to the EXTERNAL MIC JACK Level: 1kHz/170mV • Transmit mode	TOP PANEL	Connect the FM deviation meter to the ANTENNA CONNECTOR via the attenuator.	±4.6kHz (#01, #11, #14, #17, #18) ±2.3kHz (#02, #03, #12, #13, #15, #16, #19)	MAIN	R126
	2	• Apply an AF Signal to the EXTERNAL MIC JACK Level: 1kHz/17mV • Transmit mode			±3.0~±4.0kHz (#01, #11, #14, #17, #18) ±1.5~±2.0kHz (#02, #03, #12, #13, #15, #16, #19)		Verify
	3	• Operation frequency: 146.000MHz and 174.000MHz • Apply an AF signal to the EXTERNAL MIC JACK Level: 1kHz/170mV • Transmit mode			Less than ±4.6kHz (#01, #11, #14, #17, #18) Less than ±2.3kHz (#02, #03, #12, #13, #15, #16, #19)		

TRANSMITTER ADJUSTMENT (Continued)

ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
TRANSMITTER S/N	1	• Operating frequency: 173.900MHz • Apply an AF signal to the EXTERNAL MIC JACK. Level: 1kHz/17mV • Transmit mode	TOP PANEL	Connect the AC milli-voltmeter to the deviation meter	The difference between an AF signal applied and not applied is as follows: More than 40dB (#01, #11, #14, #17, #18) More than 34dB (#02, #03, #12, #13, #15, #16, #19)		Verify
	2	• Apply no AF signal to the EXTERNAL MIC JACK.					
SUBAUDIBLE TONE	1	• Operating frequency: 173.900MHz • FM deviation meter: HPF (50Hz) OFF LPF (20Hz) ON • Tone number: 01 • Apply no AF signal to the EXTERNAL MIC JACK. • Transmit mode	TOP PANEL	Connect the FM deviation meter to the ANTENNA CONNECTOR via an attenuator.	±0.75kHz (#01, #11, #14, #17, #18) ±0.3kHz (#02, #03, #12, #13, #15, #16, #19)	MAIN	R122
	2	• Tone number: 38 • Transmit mode			±0.5~±1.0kHz (#01, #11, #14, #17, #18) ±0.25~±0.5kHz (#02, #03, #12, #13, #15, #16, #19)		Verify

MAIN UNIT

PLL UNIT

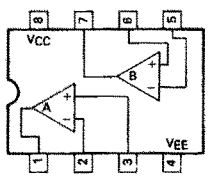


SECTION 7 BOARD LAYOUTS

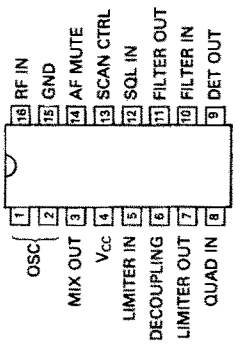
7 - 1 MAIN UNIT

- **ICs**

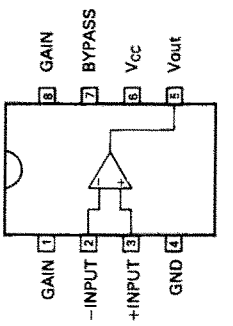
µPC358C
(Dual Driver)
IC101



MC3357P
(Low Power FM IF)
IC102

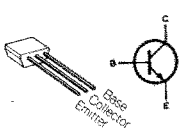


LM386N-3
(Low Voltage
Audio Power Amplifier)
IC103

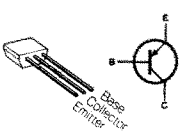


- **Transistors**

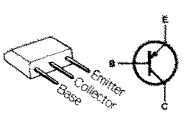
2SC2458 GR
Q101, Q102, Q104,
Q107, Q110, Q112,
Q114, Q116, Q118,
Q121, Q123, Q124,
Q125



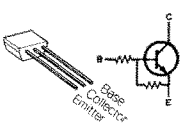
2SA1048 GR
Q103, Q105, Q106,
Q108, Q109



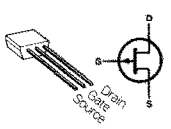
2SB909M R
Q111, Q113, Q115
Q117, Q122



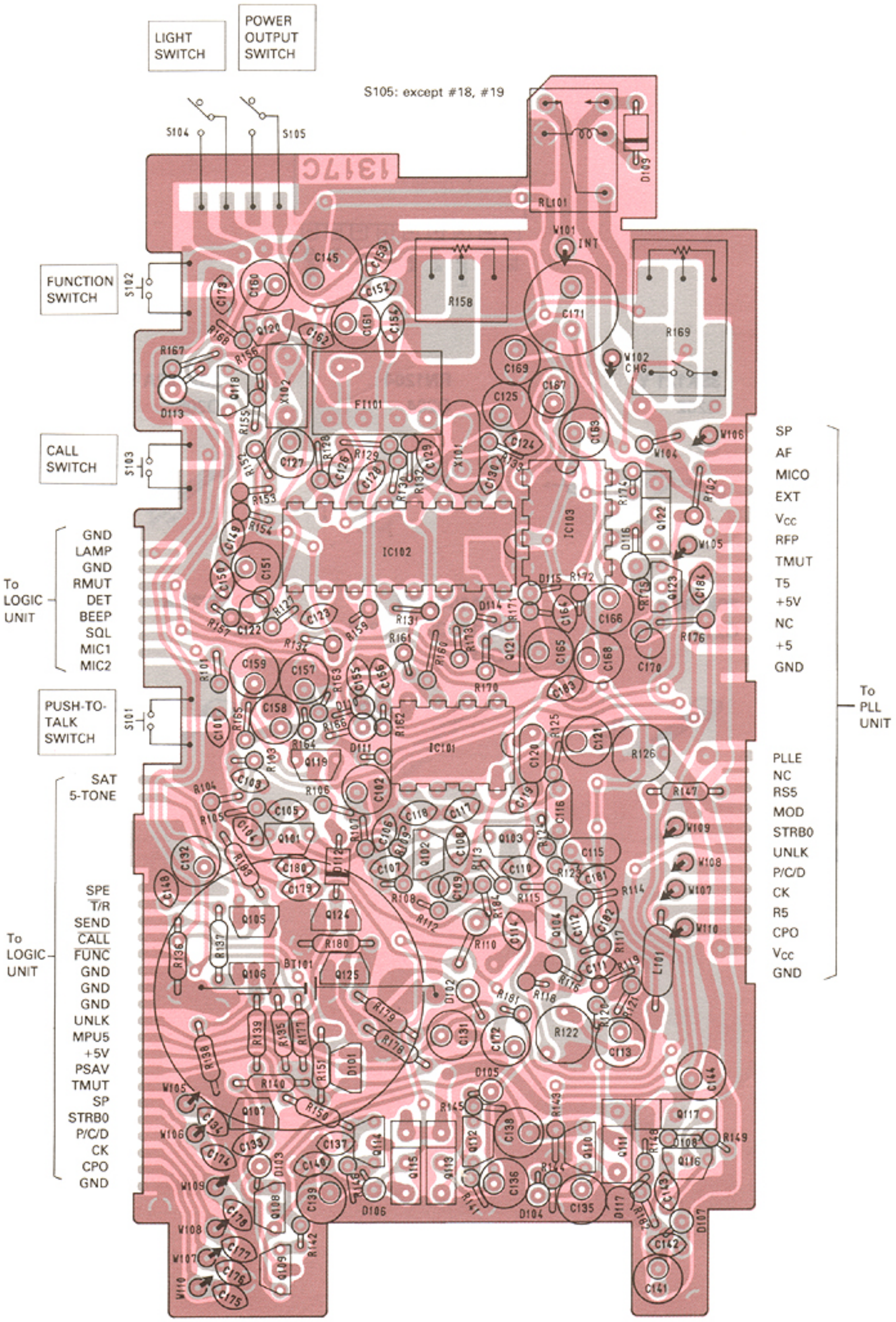
RN1204
Q119



2SJ105 Y
Q120



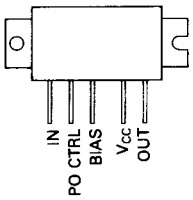
• MAIN UNIT


LIGHT SWITCH
POWER OUTPUT SWITCH
S105: except #18, #19
S104
S105
RL101
W101 INT
W102 CHG
FUNCTION SWITCH
S102
CALL SWITCH
S103
PUSH-TO-TALK SWITCH
S101
FI101
IC101
IC102
IC103
X101
X102
BT101
L101
To LOGIC UNIT
GND
LAMP
GND
RMUT
DET
BEEP
SQL
MIC1
MIC2
SAT 5-TONE
SPE
T/R
SEND
CALL
FUNC
GND
GND
GND
UNLK
MPU5
+5V
PSAV
TMUT
SP
STRB0
P/C/D
CK
CPO
GND
SP
AF
MICO
EXT
Vcc
RFP
TMUT
T5
+5V
NC
+5
GND
To PLL UNIT
PLLE
NC
RS5
MOD
STRB0
UNLK
P/C/D
CK
R5
CPO
Vcc
GND

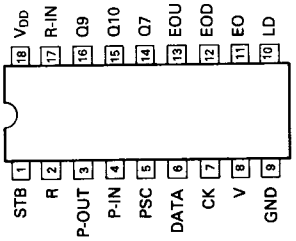
7 - 2 PLL UNIT

- **ICs**

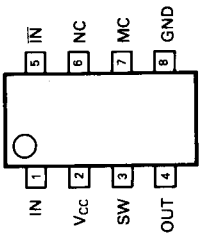
SC-1046
(VHF Power Module)
IC201



μPD2834C
(PLL Frequency Synthesizer)
IC202

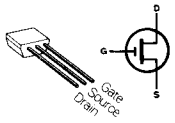


MB504
(High Speed Prescaler)
IC203

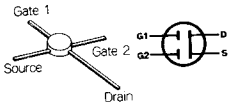


- **Transistors**

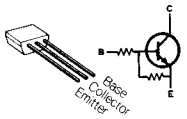
2SK241 Y
Q201, Q203



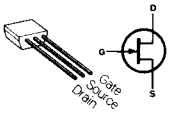
3SK121 Y
Q202



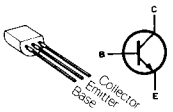
RN1204
Q204



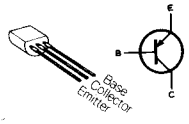
2SK192A Y
Q205



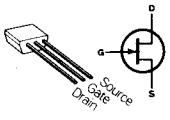
2SC2026
Q206, Q208, Q209



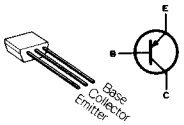
2SB561C
Q207



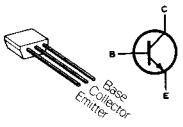
2SK184 Y
Q210



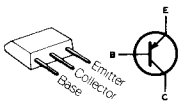
2SA1048 GR
Q211, Q217, Q218, Q219



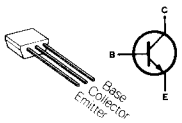
2SC3327 B
Q213



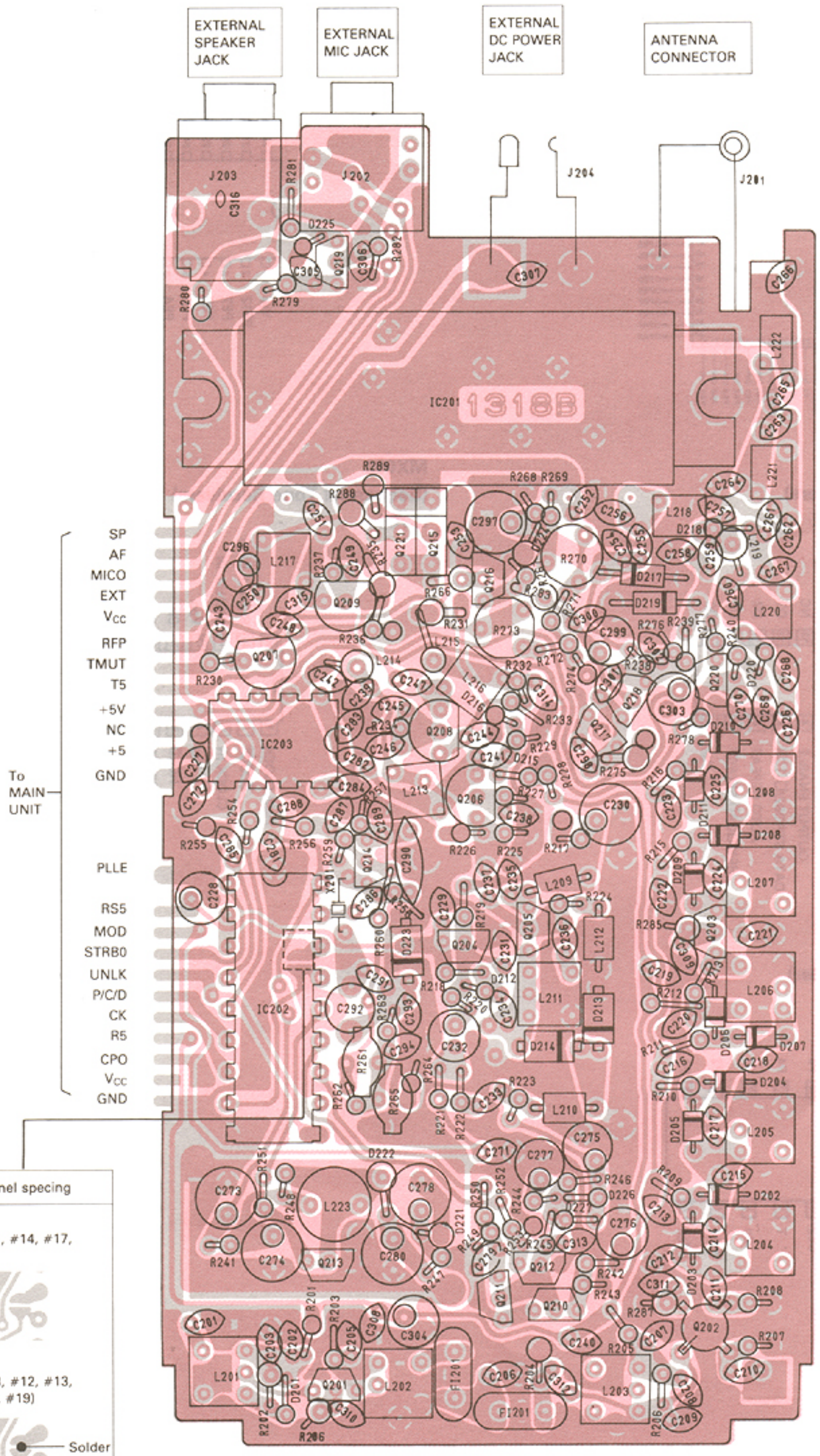
2SB909M R
Q215, Q221



2SC2458 GR
Q212, Q214, Q216, Q220



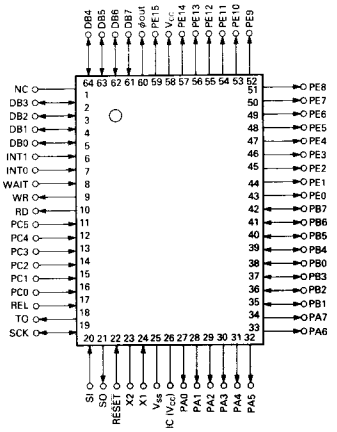
• PLL UNIT


EXTERNAL SPEAKER JACK
EXTERNAL MIC JACK
EXTERNAL DC POWER JACK
ANTENNA CONNECTOR
IC201 1318B
IC202
IC203
SP
AF
MICO
EXT
Vcc
RFP
TMUT
T5
+5V
NC
+5
GND
To MAIN UNIT
PLLE
RS5
MOD
STRB0
UNLK
P/C/D
CK
R5
CPO
Vcc
GND
Channel specing
25 kHz (#01, #11, #14, #17, #18)
12.5 kHz (#02, #03, #12, #13, #15, #16, #19)
Solder

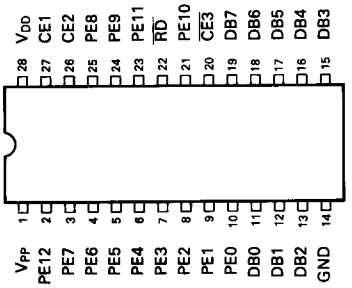
7 - 3 - 1 LOGIC UNIT (COMPONENT SIDE) (#01, #02, #03)

- **ICs**

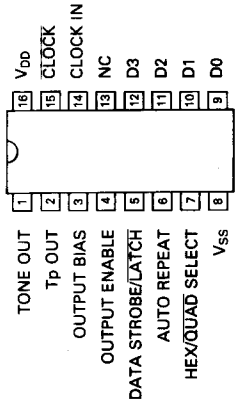
μPD78C06AG-570-12 (MPU)
IC701



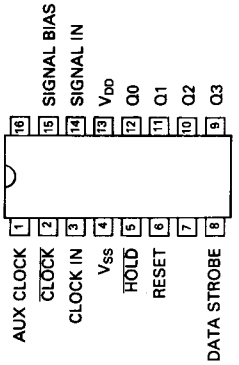
SC-1073 (65536-Bit CMOS UV EPROM)
IC702



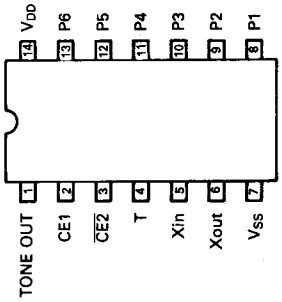
MX503
(Sequential Tone Encoders)
IC707



MX003
(Sequential Tone Receivers)
IC708

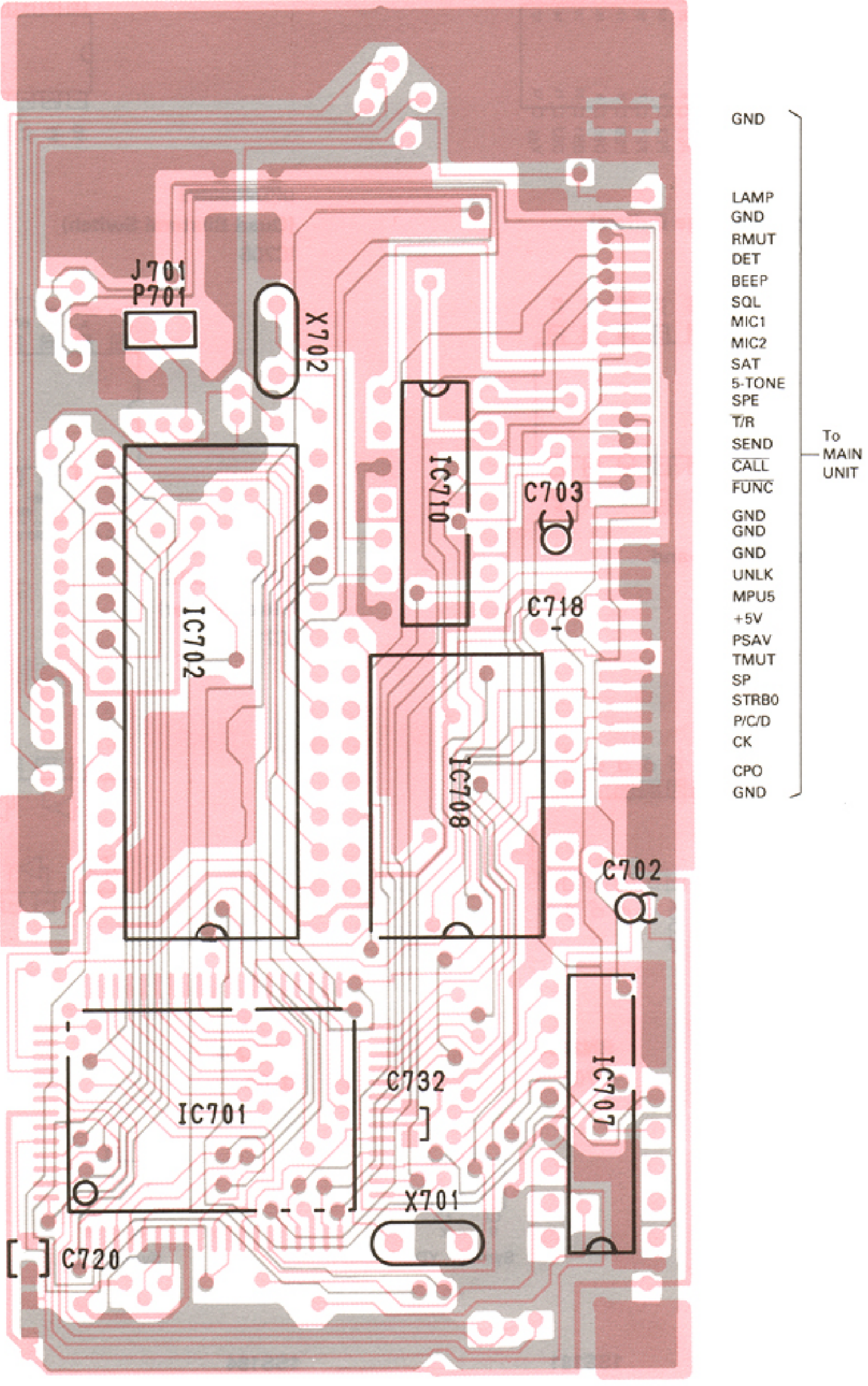


S7116A
(Subaudible Tone Encoder)
IC710



- **LOGIC UNIT (#01, #02, #03)**

COMPONENT SIDE



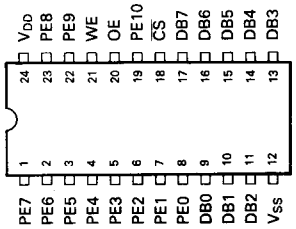
Patterns show component side and central conductor.

7 - 3 LOGIC UNIT

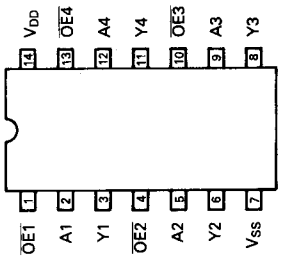
7 - 3 - 2 LOGIC UNIT (FOIL SIDE)

(#01, #02, #03)

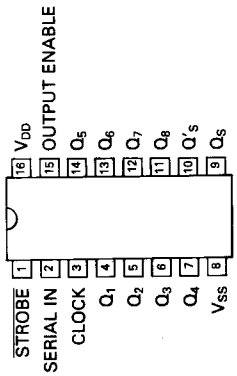
µPD446G (16384-Bit Static C-MOS RAM)
IC703



µPD74HC125G (Quad Noninverting 3-stage Buffers)
IC705

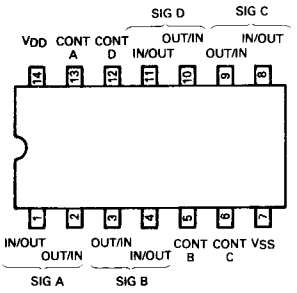


µPD4094BG (8-stage Shift-and Store Register)
IC709

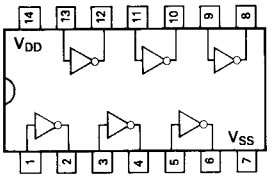


µPD74HC42G (BCD-To-Decimal Decoder)
IC704

µPD4066BG (Quad Bilateral Switch)
IC706

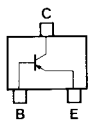


µPD4069UBG (Hex Inverter)
IC711



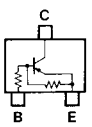
- **Transistors**

2SA1162 Y
Q701



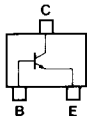
Symbol: SY

RN2404
Q702



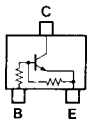
Symbol: YD

2SC2712 Y
Q703



Symbol: LY

RN1404
Q704



Symbol: XD

- **Diodes**

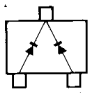
RD5.1M B2
D701

Symbol: 512

1SS181
D702, D703, D708

Symbol: A3

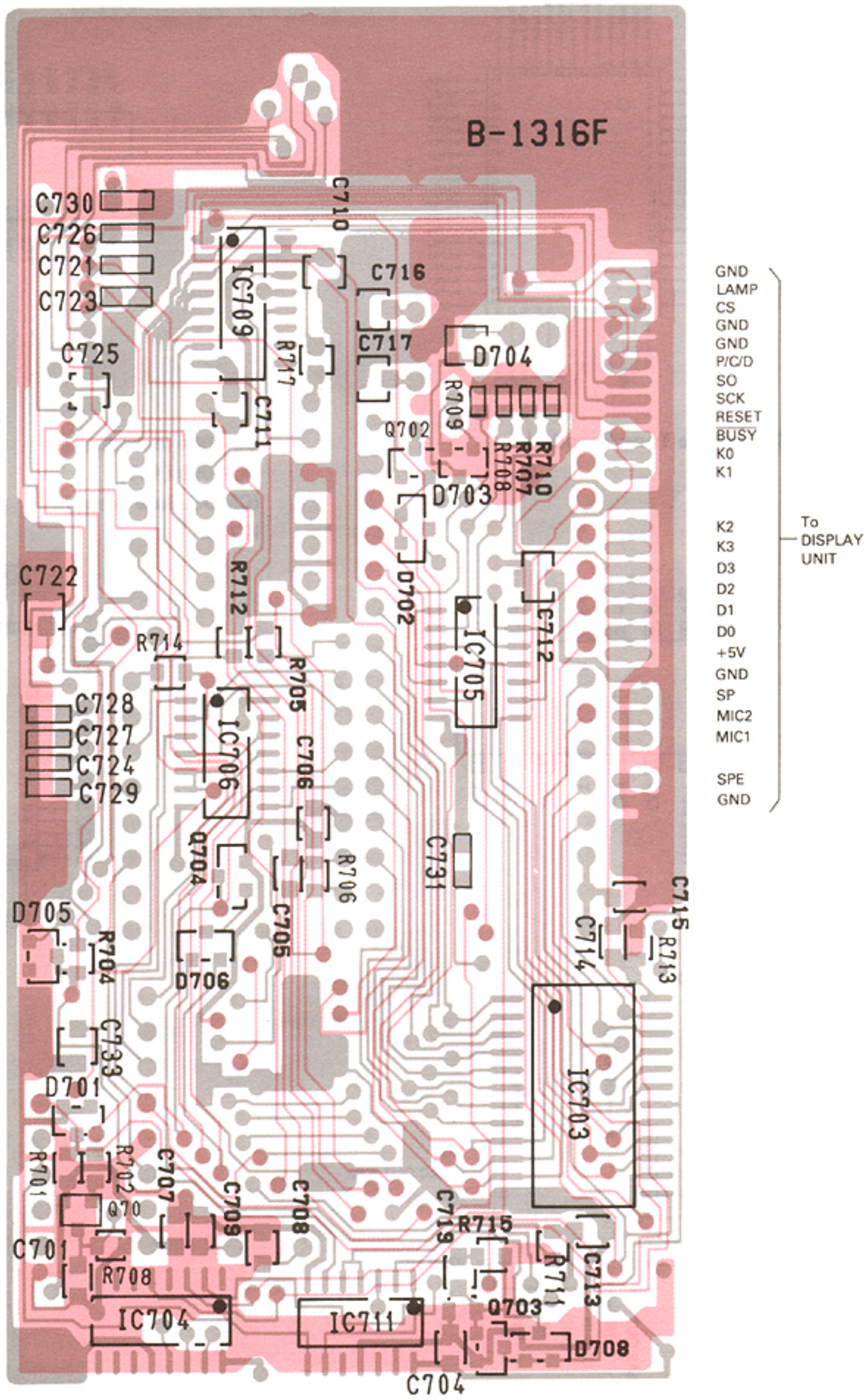
1SS184
D704, D705, D706



Symbol: B3

- **LOGIC UNIT (#01, #02, #03)**

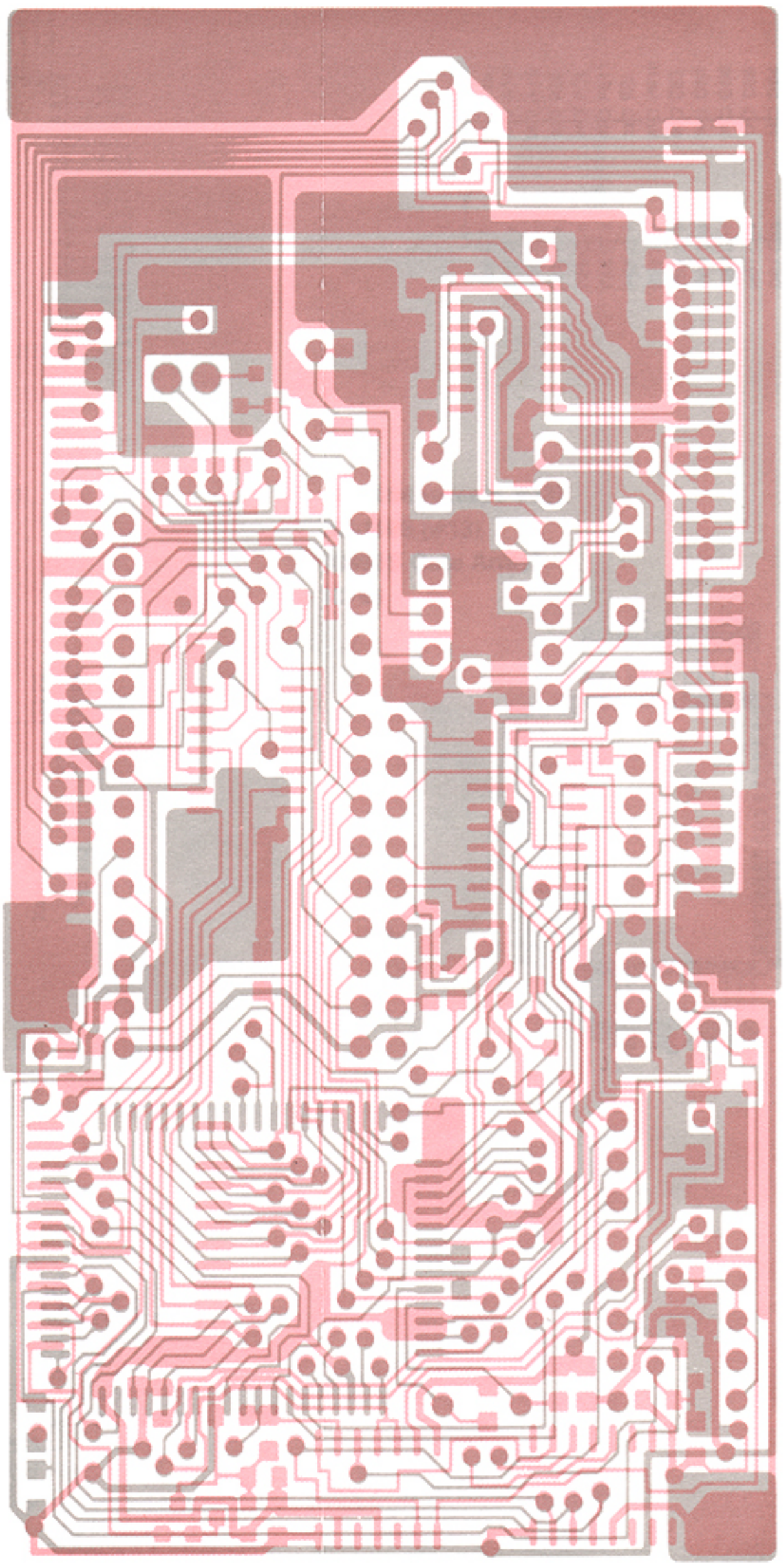
FOIL SIDE



Patterns show foil side and central conductor.

- **LOGIC UNIT (#01, #02, #03)**

COMPONENT SIDE AND FOIL SIDE PATTERNS

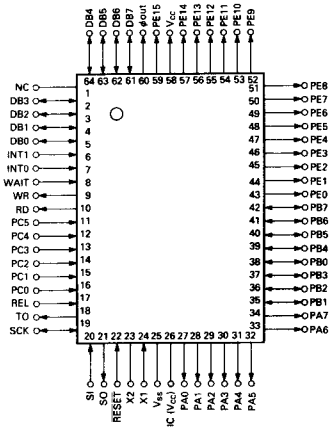


7 - 4 LOGIC-A UNIT

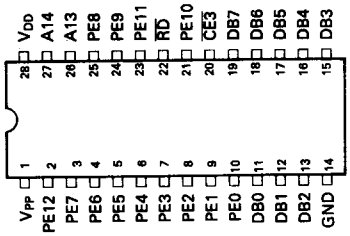
7 - 4 - 1 LOGIC-A UNIT (COMPONENT SIDE)
(#11, #12, #13, #14, #15, #16, #17, #18, #19)

- **ICs**

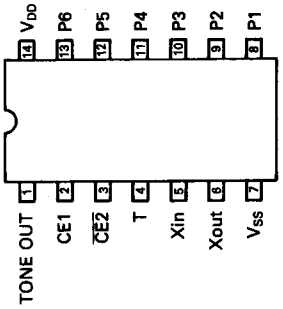
µPD78C06AG-570-12 (MPU)
IC701



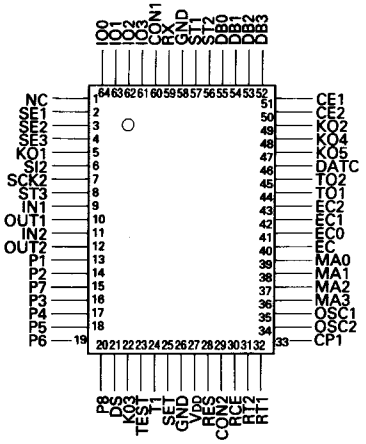
SC-1085 (262144-Bit CMOS One-Time PROM)
IC102



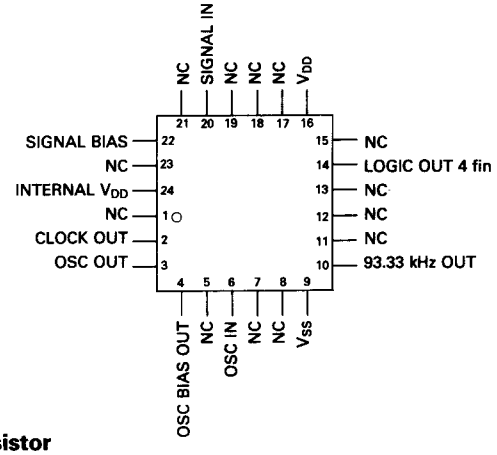
S7116A (Subaudible Tone Encoder)
IC704



SC-1084 (except #13)
SC-1093 (#13)
(CMOS Gate Array)
IC705

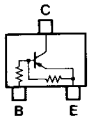


FX-102LG (Correlator)
IC706



- **Transistor**

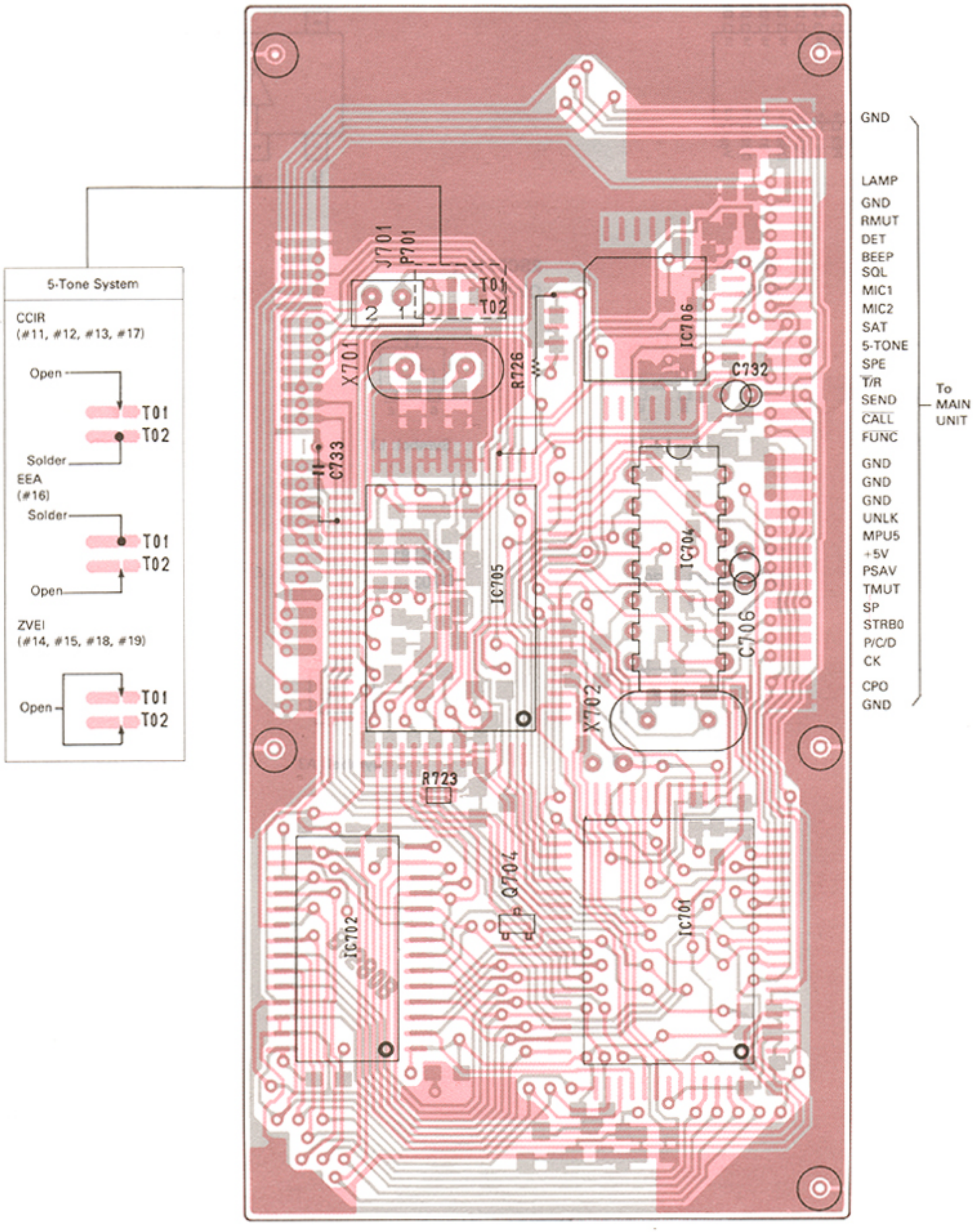
RN2404
Q704



Symbol: YD

- **LOGIC-A UNIT (#11, #12, #13, #14, #15, #16, #17, #18, #19)**

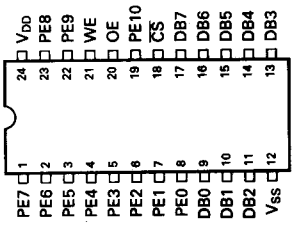
COMPONENT SIDE



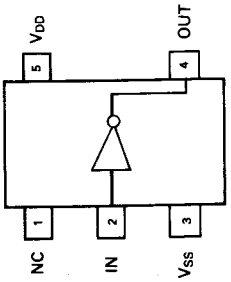
7 - 4 - 2 LOGIC-A UNIT (FOIL SIDE)
(#11, #12, #13, #14, #15, #16, #17, #18, #19)

- **ICs**

µPD446G (16384-Bit Static CMOS RAM)
IC703

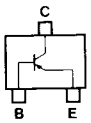


TC4SU69 F (Inverter Gate)
IC707



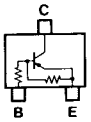
- **Transistors**

2SA1162 Y
Q701



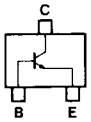
Symbol: SY

RN2404
Q702



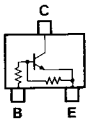
Symbol: YD

2SC2712 Y
Q703



Symbol: LY

RN1404
Q705



Symbol: XD

- **Diodes**

RD5.1M B2
D701

Symbol: 512

1SS184
D702, D704, D705, D706, D707

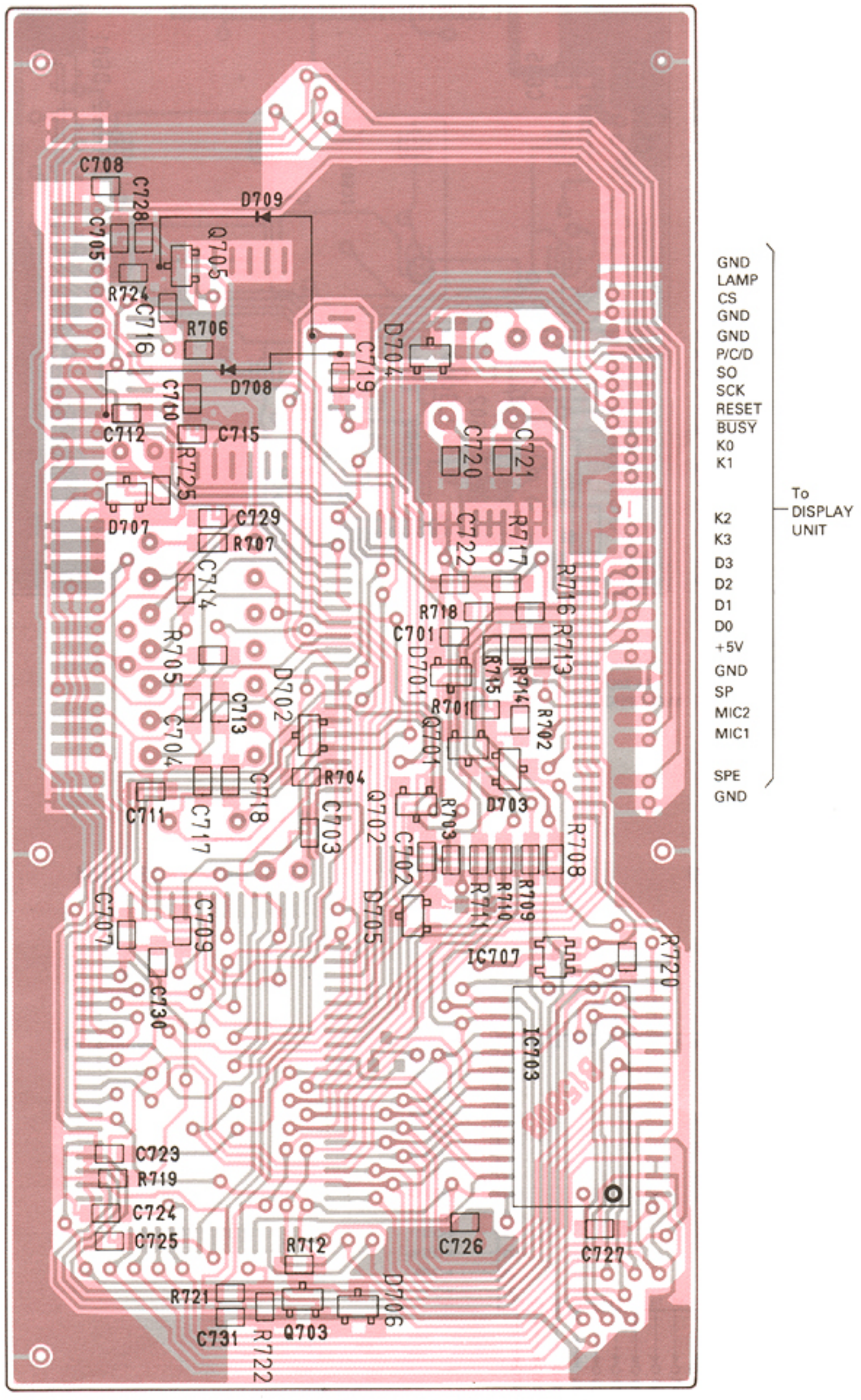
Symbol: B3

1SS181
D703

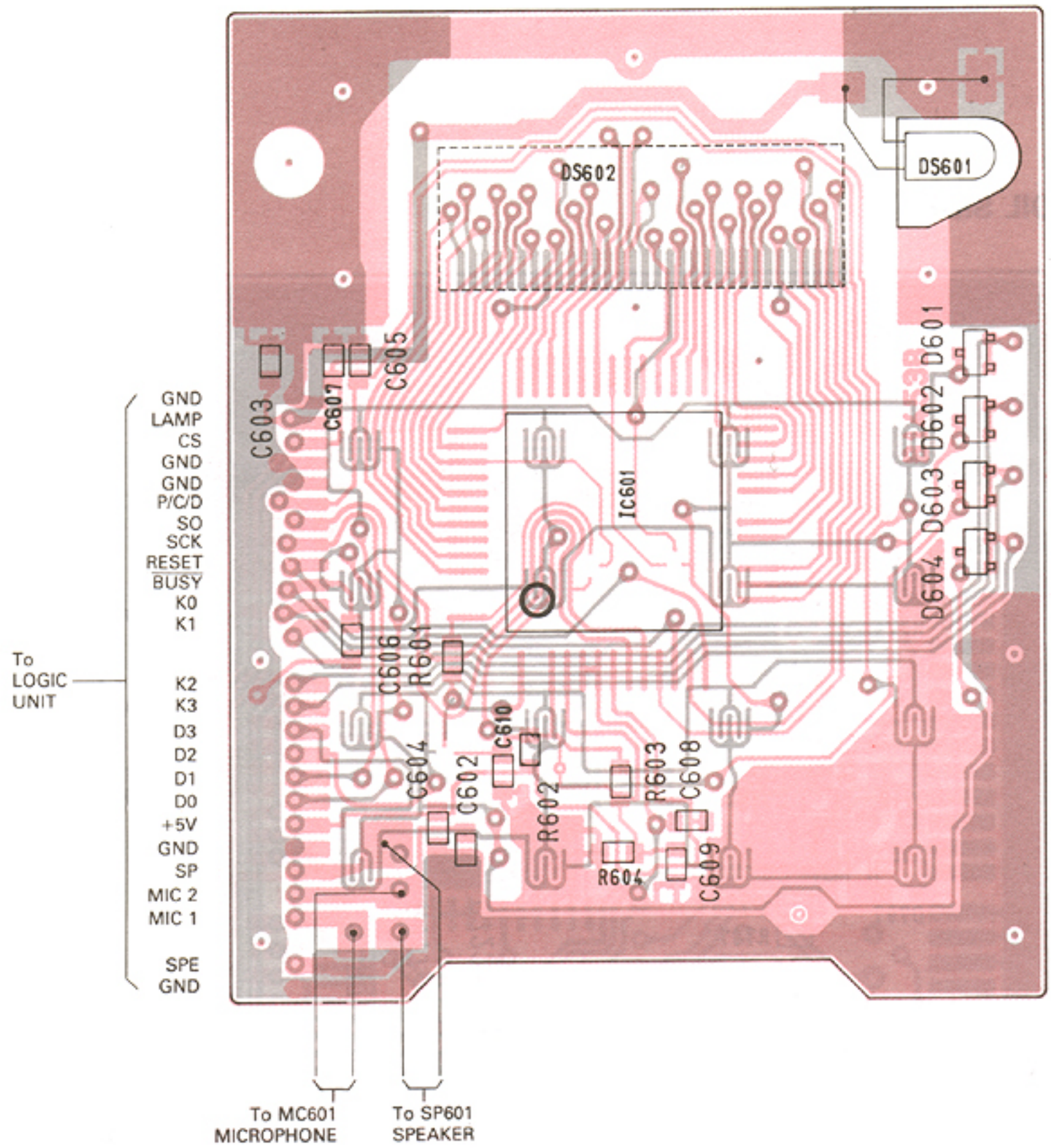
Symbol: A3

- **LOGIC-A UNIT (#11, #12, #13, #14, #15, #16, #17, #18, #19)**

FOIL SIDE

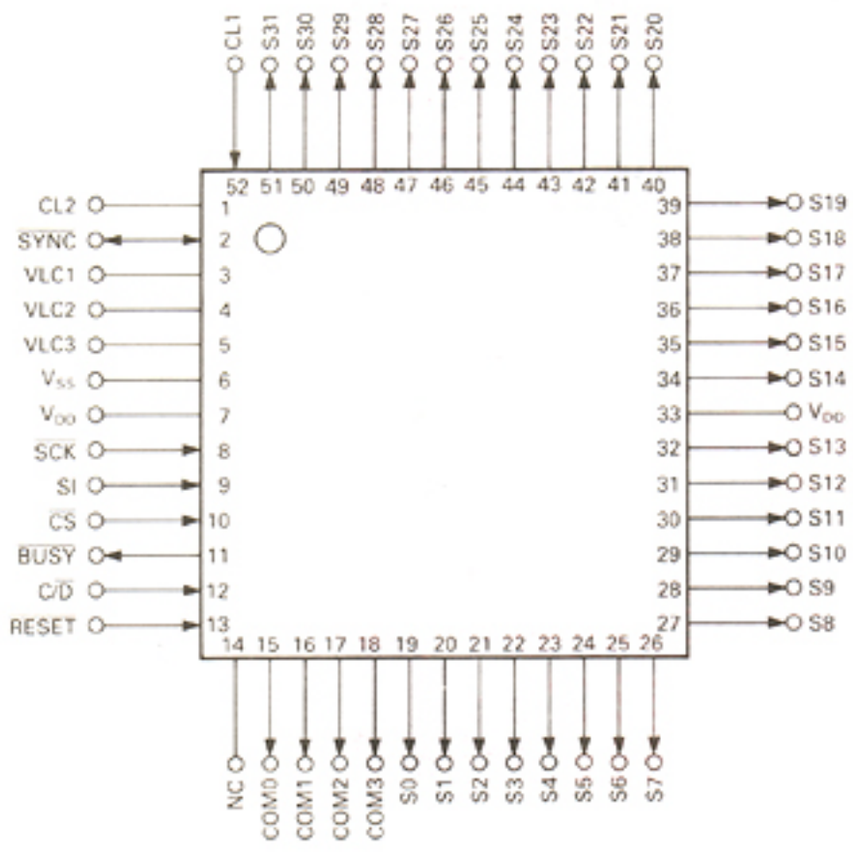


7 - 5 DISPLAY UNIT



- **IC**

µPD7225G
(Programmable LCD Driver)
IC601



- **Diodes**

1SS193
D601, D602, D603, D604

Symbol: F3

SECTION 8 PARTS LIST

8-1 MAIN UNIT

REF. NO.	DESCRIPTION	PART NO.
IC101	IC	μPC358C
IC102	IC	MC3357P
IC103	IC	LM386N-3
Q101	Transistor	2SC2458 GR
Q102	Transistor	2SC2458 GR
Q103	Transistor	2SA1048 GR
Q104	Transistor	2SC2458 GR
Q105	Transistor	2SA1048 GR
Q106	Transistor	2SA1048 GR
Q107	Transistor	2SC2458 GR
Q108	Transistor	2SA1048 GR
Q109	Transistor	2SA1048 GR
Q110	Transistor	2SC2458 GR
Q111	Transistor	2SB909M R
Q112	Transistor	2SC2458 GR
Q113	Transistor	2SB909M R
Q114	Transistor	2SC2458 GR
Q115	Transistor	2SB909M R
Q116	Transistor	2SC2458 GR
Q117	Transistor	2SB909M R
Q118	Transistor	2SC2458 GR
Q119	Transistor	RN1204
Q120	FET	2SJ105 Y
Q121	Transistor	2SC2458 GR
Q122	Transistor	2SB909M R
Q123	Transistor	2SC2458 GR
Q124	Transistor	2SC2458 GR
Q125	Transistor	2SC2458 GR
D101	Diode	1SS233
D102	Diode	1SS211
D103	Diode	1SS211
D104	Diode	1SS211
D105	Diode	1SS211
D106	Diode	1SS211
D107	Zener	RD5.1JS B2
D108	Diode	1SS211
D109	Diode	1SS211
D110	Diode	1SS211
D111	Diode	1SS211
D112	Diode	1SS211
D113	Diode	1SS211
D114	Diode	1SS211
D115	Diode	1SS211
D116	Zener	RD4.7E B2
D117	Zener	RD6.8E B2
FI101	Ceramic	CFW455E (#01, #11, #14, #17, #18) CFW455HT (#02, #03, #12, #13, #15, #16, #19)

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.
X101	Crystal	CR-70
X102	Discriminator	CDB455 C7A
L101	Choke	LAL03NA 100K
R101	Resistor	33kΩ ELR10
R102	Resistor	1kΩ ELR10
R103	Resistor	1kΩ ELR10
R104	Resistor	1.2kΩ ELR10
R105	Resistor	100kΩ ELR10
R106	Resistor	120kΩ ELR10
R107	Resistor	470Ω ELR10
R108	Resistor	5.6kΩ ELR10
R109	Resistor	10kΩ ELR10
R110	Resistor	33kΩ ELR10
R112	Resistor	470Ω ELR10
R113	Resistor	330kΩ ELR10
R114	Resistor	1kΩ ELR10
R115	Resistor	2.2kΩ ELR10
R116	Resistor	3.3kΩ ELR10
R117	Resistor	220kΩ ELR10
R118	Resistor	150kΩ ELR10
R119	Resistor	39kΩ ELR10
R120	Resistor	33kΩ ELR10
R121	Resistor	33kΩ ELR10
R122	Trimmer	100kΩ RH0521C15J052A
R123	Resistor	39kΩ ELR10
R124	Resistor	39kΩ ELR10 (#01, #11, #14, #17, #18) 56kΩ ELR10 (#02, #03, #12, #13, #15, #16, #19)
R125	Resistor	12kΩ ELR10
R126	Trimmer	100kΩ RH0521C15J05A
R127	Resistor	470Ω ELR10
R128	Resistor	1.5kΩ ELR10
R129	Resistor	47kΩ ELR10
R130	Resistor	1.5kΩ ELR10 (#01, #11, #14, #17, #18) 2.2kΩ ELR10 (#02, #03, #12, #13, #15, #16, #19)
R131	Resistor	100kΩ ELR10
R132	Resistor	1.5kΩ ELR10 (#01, #11, #14, #17, #18) 2.2kΩ ELR10 (#02, #03, #12, #13, #15, #16, #19)
R133	Resistor	22kΩ ELR10
R134	Resistor	180kΩ ELR10 (#01, #11, #14, #17, #18) 68kΩ ELR10 (#02, #03, #12, #13, #15, #16, #19)
R135	Resistor	560Ω R10

[MAIN UNIT]

REF. NO.	DESCRIPTION		PART NO.
R136	Resistor	10kΩ	R10
R137	Resistor	100kΩ	R10
R138	Resistor	100kΩ	R10
R139	Resistor	220kΩ	R10
R140	Resistor	33kΩ	R10
R141	Resistor	10kΩ	ELR10
R142	Resistor	180kΩ	ELR10
R143	Resistor	10kΩ	ELR10
R144	Resistor	10kΩ	ELR10
R145	Resistor	10kΩ	ELR10
R146	Resistor	10kΩ	ELR10
R147	Resistor	10Ω	R10
R148	Resistor	2.7kΩ	ELR10
R149	Resistor	10kΩ	ELR10
R150	Resistor	1kΩ	R10
R151	Resistor	100kΩ	R10
R152	Resistor	6.8kΩ	ELR10
R153	Resistor	1MΩ	ELR10
R154	Resistor	470kΩ	ELR10
R155	Resistor	4.7kΩ	ELR10
R156	Resistor	820Ω	ELR10
R157	Resistor	12kΩ	ELR10
R158	Variable	10kΩB	RK094111000NA
R159	Resistor	5.6kΩ	ELR10
R160	Resistor	180kΩ	ELR10
R161	Resistor	330kΩ	ELR10
R162	Resistor	1MΩ	ELR10
R163	Resistor	100kΩ	ELR10
R164	Resistor	1kΩ	ELR10
R165	Resistor	150kΩ	ELR10
R166	Resistor	820kΩ	ELR10
R167	Resistor	470kΩ	ELR10
R168	Resistor	1MΩ	ELR10
R169	Variable	10kΩA	RK0941111003A
R170	Resistor	220kΩ	ELR10
R171	Resistor	150kΩ	ELR10
R172	Resistor	150kΩ	ELR10
R173	Resistor	33kΩ	ELR10
R174	Resistor	1.8kΩ	ELR10
		(#01, #11, #14, #17, #18)	
		470Ω	ELR10
		(#02, #03, #12, #13, #15, #16, #19)	
R175	Resistor	1.2kΩ	ELR10
R176	Resistor	47kΩ	ELR10
R177	Resistor	100kΩ	R10
R178	Resistor	470kΩ	R10
R179	Resistor	33kΩ	R10
R180	Resistor	39kΩ	R10
R181	Resistor	120kΩ	ELR10
R182	Resistor	3.3kΩ	ELR10
R183	Resistor	10kΩ	R10
R184	Resistor	56kΩ	ELR10
C101	Ceramic	0.001μF	50V
C102	Electrolytic	10μF	16V RC3
C103	Barrier Layer	0.01μF	25V
C104	Ceramic	470pF	50V
C105	Ceramic	470pF	50V
C106	Ceramic	470pF	50V
C107	Ceramic	470pF	50V

[MAIN UNIT]

REF. NO.	DESCRIPTION		PART NO.
C108	Ceramic	470pF	50V
C109	Tantalum	0.1μF	35V DN
C110	Ceramic	470pF	50V
C111	Ceramic	470pF	50V
C112	Ceramic	0.001μF	50V
C113	Electrolytic	0.22μF	50V RC3
C114	Ceramic	0.001μF	50V
C115	Mylar	0.0022μF	50V
C116	Mylar	0.01μF	50V
C117	Ceramic	470pF	50V
C118	Ceramic	100pF	50V
		(#01, #11, #14, #17, #18)	
		120pF	50V
		(#02, #03, #12, #13, #15, #16, #19)	
C119	Ceramic	470pF	50V
C120	Mylar	0.0022μF	50V
C121	Electrolytic	1μF	50V RC3
C122	Tantalum	0.1μF	35V DN
C123	Ceramic	0.001μF	50V
C124	Barrier Layer	0.01μF	25V
C125	Electrolytic	10μF	16V RC3
C126	Ceramic	82pF	50V
C127	Tantalum	0.1μF	35V DN
C128	Ceramic	0.1μF	D33Y5V1E104Z21
C129	Ceramic	68pF	50V
C130	Ceramic	120pF	50V
C131	Electrolytic	47μF	6.3V RC3
C132	Electrolytic	4.7μF	50V RC3
C133	Ceramic	0.001μF	50V
C134	Ceramic	470pF	50V
C135	Electrolytic	22μF	6.3V RC3
C136	Electrolytic	22μF	6.3V RC3
C137	Ceramic	470pF	50V
C138	Electrolytic	2.2μF	50V RC3
C139	Electrolytic	22μF	6.3V RC3
C140	Ceramic	0.001μF	50V
C141	Electrolytic	22μF	6.3V RC3
C142	Ceramic	0.001μF	50V
C143	Ceramic	470pF	50V
C144	Electrolytic	22μF	6.3V RC3
C145	Electrolytic	47μF	25V MS7
C146	Ceramic	470pF	50V
C147	Ceramic	470pF	50V
C148	Ceramic	470pF	50V
C149	Barrier Layer	0.01μF	25V
C150	Ceramic	0.1μF	D33Y5V1E104Z21
C151	Electrolytic	0.1μF	50V RC3
C152	Ceramic	0.001μF	50V
		(#01, #11, #14, #17, #18)	
	Barrier Layer	0.0022μF	25V
		(#02, #03, #12, #13, #15, #16, #19)	
C153	Ceramic	47pF	50V
C154	Ceramic	0.001μF	50V
C155	Ceramic	10pF	50V
C156	Ceramic	0.001μF	50V
C157	Tantalum	0.47μF	35V DN
C158	Electrolytic	0.22μF	50V RC3
C159	Electrolytic	0.22μF	50V RC3
C160	Electrolytic	1μF	50V RC3
C161	Electrolytic	1μF	50V RC3

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.
C162	Barrier Layer	0.0056μF 25V
C163	Ceramic	0.1μF D33Y5V1E104Z21
C164	Ceramic	470pF 50V
C165	Electrolytic	2.2μF 50V RC3
C166	Electrolytic	10μF 16V RC3
C167	Electrolytic	10μF 16V RC3
C168	Electrolytic	10μF 16V RC3
C169	Tantalum	2.2μF 16V DN
C170	Tantalum	0.68μF 35V DN
C171	Electrolytic	220μF 10V
C172	Electrolytic	4.7μF 25V RC3
C173	Ceramic	470pF 50V
C174	Ceramic	470pF 50V
C175	Ceramic	47pF 50V
C176	Ceramic	47pF 50V
C177	Ceramic	47pF 50V
C178	Ceramic	47pF 50V
C179	Ceramic	0.1μF D33Y5V1E104Z21
C180	Ceramic	0.1μF D33Y5V1E104Z21
C181	Ceramic	120pF 50V
C182	Ceramic	470pF 50V
C183	Ceramic	0.1μF D33Y5V1E104Z21
C184	Ceramic	0.1μF D33Y5V1E104Z21
RL101	Relay	OUC-SS-114D
S101	Switch	SKHHAK013A
S102	Switch	SKHHAK013A
S103	Switch	SKHHAK013A
S104	Switch	SPPH22039A
S105	Switch	SPPH22014A (except #18, #19)
BT101	Lithium Battery	BR2325-1HC
EP101	P.C. Board	B-1317C (MAIN)
EP102	P.C. Board	B-908 (SW)
EP103	F.P.C. Board	B-1045
EP104	Bead Core	DL2-OP2.6-3-1.2H
EP105	Irrax Tube	d=0.7 L=3mm
EP106	Crystal Seat	41590
EP108	Bead Core	FSQH050RN
EP109	Bead Core	FSQH050RN
EP110	Bead Core	FSQH050RN
EP111	Irrax Tube	d=0.7 L=3mm
W101	Wire	23/03/145/D21/W01
W102	Wire	23/02/115/D21/W01
W103	Wire	23/04/040/W02/W02
W104	Wire	72/99/050/X98/X98
W105	Wire	23/01/130/D21/D21
W106	Wire	23/05/135/D21G/D21G
W107	Wire	23/06/090/D21/D21
W108	Wire	23/07/095/D21/D21
W109	Wire	23/08/100/D21/D21
W110	Wire	23/09/085/D21/D21

8-2 PLL UNIT

REF. NO.	DESCRIPTION	PART NO.
IC201	IC	SC-1046
IC202	IC	μPD2834C
IC203	IC	MB504
Q201	FET	2SK241 Y
Q202	FET	3SK121 Y
Q203	FET	2SK241 Y
Q204	Transistor	RN1204
Q205	FET	2SK192A Y
Q206	Transistor	2SC2026
Q207	Transistor	2SB561C
Q208	Transistor	2SC2026
Q209	Transistor	2SC2026
Q210	FET	2SK184Y
Q211	Transistor	2SA1048 GR
Q212	Transistor	2SC2458 GR
Q213	Transistor	2SC3327 B
Q214	Transistor	2SC2458 GR
Q215	Transistor	2SB909M R
Q216	Transistor	2SC2458 GR
Q217	Transistor	2SA1048 GR
Q218	Transistor	2SA1048 GR
Q219	Transistor	2SA1048 GR
Q220	Transistor	2SC2458 GR
Q221	Transistor	2SB909M R
D201	Diode	1SS133
D202	Varicap	1SV153
D203	Varicap	1SV153
D204	Varicap	1SV153
D205	Varicap	1SV153
D206	Varicap	1SV153
D207	Varicap	1SV153
D208	Varicap	1SV153
D209	Varicap	1SV153
D210	Varicap	1SV153
D211	Varicap	1SV153
D212	Diode	1SS216
D213	Varicap	1SV50E
D214	Varicap	1SV50E
D215	Diode	1SS216
D216	Diode	1SS216
D217	Diode	1SS97
D218	Diode	1SS216
D219	Diode	1SS97
D220	Diode	1SS216
D221	Zener	RD20E B1
D222	Diode	1SS130
D223	Varicap	1SV50E
D224	Zener	RD5.1JS B2
D225	Diode	1SS211
D226	Diode	1SS133
D227	Diode	1SS133
FI201	Monolithic	21M15B3 (#01, #11, #14, #17, #18) 21M7B2 (#02, #03, #12, #13, #15, #16, #19)

[PLL UNIT]

REF. NO.	DESCRIPTION	PART NO.	
X201	Crystal	CR-164 (#01, #11, #14, #18) CR-85 (#02, #03, #12, #13, #15, #16, #17, #19)	
L201	Coil	LS-263	
L202	Coil	LS-264	
L203	Coil	LS-264	
L204	Coil	LS-295	
L205	Coil	LS-295	
L206	Coil	LS-296	
L207	Coil	LS-295	
L208	Coil	LS-295	
L209	Choke	LAL02TA 4R7	
L210	Choke	LAL02TA 4R7	
L211	Coil	LB-188	
L212	Choke	LAL02TA 4R7	
L213	Coil	LA-237	
L214	Choke	LAL03NA 221K	
L215	Choke	LAL03NA 221K	
L216	Coil	LA-237	
L217	Coil	LA-237	
L218	Coil	LA-235	
L219	Choke	LAL03NA 4R7	
L220	Coil	LA-237	
L221	Coil	LA-235	
L222	Coil	LA-234	
L223	Choke	LW-30	
R201	Resistor	100Ω	ELR10
R202	Resistor	10kΩ	ELR10
R203	Resistor	10kΩ	ELR10
R204	Resistor	1.5kΩ	ELR10
R205	Resistor	100Ω	ELR10
R206	Resistor	820Ω	ELR10
R207	Resistor	47kΩ	ELR10
R208	Resistor	100kΩ	ELR10
R209	Resistor	150kΩ	ELR10
R210	Resistor	150kΩ	ELR10
R221	Resistor	150kΩ	ELR10
R212	Resistor	100Ω	ELR10
R213	Resistor	6.8kΩ	ELR10
R215	Resistor	150kΩ	ELR10
R216	Resistor	150kΩ	ELR10
R217	Resistor	100Ω	ELR10
R218	Resistor	8.2kΩ	ELR10
R219	Resistor	6.8kΩ	ELR10
R220	Resistor	12kΩ	ELR10
R221	Resistor	10kΩ	ELR10
R222	Resistor	220kΩ	ELR10
R223	Resistor	2.2kΩ	ELR10
R224	Resistor	100Ω	ELR10
R225	Resistor	4.7kΩ	ELR10
R226	Resistor	5.6kΩ	ELR10
R227	Resistor	220Ω	ELR10
R228	Resistor	10kΩ	ELR10
R229	Resistor	22kΩ	ELR10
R230	Resistor	4.7kΩ	ELR10
R231	Resistor	10kΩ	ELR10

[PLL UNIT]

REF. NO.	DESCRIPTION	PART NO.	
R232	Resistor	5.6kΩ	ELR10
R233	Resistor	4.7kΩ	ELR10
R234	Resistor	220Ω	ELR10
R235	Resistor	560Ω	ELR10
R236	Resistor	1.2kΩ	ELR10
R237	Resistor	47Ω	ELR10
R238	Resistor	4.7kΩ	ELR10
R239	Resistor	4.7kΩ	ELR10
R240	Resistor	100Ω	ELR10
R241	Resistor	330Ω	ELR10
R242	Resistor	10kΩ	ELR10
R243	Resistor	120kΩ	ELR10
R244	Resistor	2.7kΩ	ELR10
R245	Resistor	5.6kΩ	ELR10
R246	Resistor	39kΩ	R10
R247	Resistor	100Ω	ELR10
R248	Resistor	10kΩ	ELR10
R249	Resistor	10kΩ	ELR10
R250	Resistor	100kΩ	ELR10
R251	Resistor	10kΩ	ELR10
R252	Resistor	100kΩ	ELR10
R253	Resistor	33kΩ	ELR10
R254	Resistor	10kΩ	ELR10
R255	Resistor	1kΩ	ELR10
R256	Resistor	100Ω	ELR10
R257	Resistor	2.2kΩ	ELR10
R258	Resistor	68kΩ	ELR10
R259	Resistor	120kΩ	R10
R260	Resistor	6.8kΩ	ELR10
R261	Thermistor	33D28	
R262	Resistor	10kΩ	ELR10
R263	Resistor	10kΩ	ELR10
R264	Resistor	15kΩ	ELR10
R265	Thermistor	33D28	
R266	Resistor	4.7kΩ	ELR10
R267	Resistor	560kΩ	ELR10
R268	Resistor	6.8kΩ	ELR10
R269	Resistor	6.8kΩ	ELR10
R270	Trimmer	22kΩ	RH0521CJ4J06A
R271	Resistor	2.2kΩ	ELR10
R272	Resistor	2.2kΩ	ELR10
R273	Trimmer	10kΩ	RH0521C14J08A
R274	Resistor	27kΩ	ELR10
R275	Resistor	82kΩ	ELR10
R276	Resistor	22kΩ	ELR10
R277	Resistor	47kΩ	ELR10
R278	Resistor	1MΩ	ELR10
R279	Resistor	27Ω	ELR10
R280	Resistor	5.6kΩ	ELR10
R281	Resistor	47kΩ	ELR10
R282	Resistor	47kΩ	ELR10
R283	Resistor	180kΩ	ELR10
R285	Resistor	18Ω	ELR10
R286	Resistor	100Ω	ELR10
R287	Resistor	470Ω	ELR10
R288	Resistor	10Ω	ELR20
R289	Resistor	10Ω	ELR20
C201	Ceramic	0.001μF	50V
C202	Ceramic	0.001μF	50V
C203	Barrier Layer	0.01μF	25V

[PLL UNIT]

REF. NO.	DESCRIPTION	PART NO.
C205	Ceramic	47pF 50V
C206	Ceramic	5pF 50V (#01, #11, #14, #17, #18)
		15pF 50V (#02, #03, #12, #13, #15, #16, #19)
C207	Ceramic	0.001µF 50V
C208	Barrier Layer	0.01µF 25V
C209	Ceramic	47pF 50V
C210	Ceramic	47pF 50V
C211	Ceramic	6pF 50V
C212	Ceramic	2pF 50V
C213	Ceramic	0.001µF 50V
C214	Ceramic	0.35pF 50V
C215	Ceramic	2pF 50V
C216	Ceramic	0.001µF 50V
C217	Ceramic	0.5pF 50V
C218	Ceramic	2pF 50V
C219	Ceramic	0.001µF 50V
C220	Ceramic	0.001µF 50V
C221	Ceramic	0.5pF 50V
C222	Ceramic	0.001µF 50V
C223	Ceramic	0.001µF 50V
C224	Ceramic	0.5pF 50V
C225	Ceramic	3pF 50V
C226	Ceramic	0.001µF 50V
C227	Ceramic	0.001µF 50V
C228	Electrolytic	2.2µF 50V RC2
C229	Ceramic	0.001µF 50V
C230	Electrolytic	47µF 6.3V RC2
C231	Ceramic	0.001µF 50V
C232	Electrolytic	10µF 16V RC3
C233	Barrier Layer	0.001µF 25V
C234	Ceramic	7pF 50V CH
C235	Ceramic	0.001µF 50V
C236	Ceramic	0.001µF 50V
C237	Ceramic	1pF 50V
C238	Ceramic	0.001µF 50V
C239	Ceramic	0.001µF 50V
C240	Ceramic	470pF 50
C241	Ceramic	22pF 50V
C242	Ceramic	0.1µF D33Y5V1E104Z21
C243	Ceramic	0.001µF 50V
C244	Ceramic	2pF 50V
C245	Ceramic	0.001µF 50V
C246	Ceramic	470pF 50V
C247	Ceramic	27pF 50V
C248	Ceramic	0.001µF 50V
C249	Ceramic	0.001µF 50V
C250	Ceramic	0.001µF 50V
C251	Ceramic	10pF 50V
C252	Ceramic	0.001µF 50V
C253	Ceramic	0.001µF 50V
C254	Ceramic	2pF 50V
C255	Barrier Layer	0.75pF 50V
C256	Ceramic	10pF 50V
C257	Ceramic	10pF 50V
C258	Ceramic	2pF 50V
C259	Ceramic	0.75pF 50V
C260	Ceramic	470pF 50V
C261	Ceramic	0.001µF 50V
C262	Ceramic	15pF 50V

[PLL UNIT]

REF. NO.	DESCRIPTION	PART NO.
C263	Ceramic	2pF 50V
C264	Ceramic	27pF 50V
C265	Ceramic	8pF 50V
C266	Ceramic	12pF 50V
C267	Ceramic	15pF 50V
C268	Ceramic	15pF 50V
C269	Ceramic	120pF 50V
C270	Ceramic	470pF 50V
C271	Ceramic	0.001µF 50V
C272	Ceramic	0.001µF 50V
C273	Electrolytic	47µF 6.3V RC2
C274	Electrolytic	47µF 6.3V RC2
C275	Tantalum	0.1µF 35V DN
C276	Electrolytic	0.1µF 50V RC2
C277	Tantalum	2.2µF 16V DN
C278	Electrolytic	10µF 35V RC2
C279	Ceramic	100pF 50V
C280	Electrolytic	10µF 35V RC2
C281	Ceramic	0.001µF 50V
C282	Ceramic	2pF 50V
C283	Ceramic	10pF 50V
C284	Ceramic	0.1µF D33Y5V1E104Z21
C285	Ceramic	0.001µF 50V
C286	Ceramic	0.001µF 50V
C287	Barrier Layer	0.01µF 25V
C288	Ceramic	0.1µF D33Y5V1E104Z21
C289	Ceramic	100pF 50V
C290	Ceramic	220pF 50V
C291	Ceramic	33pF 50V CH
C292	Trimmer	20pF ECRGA020E30
C293	Ceramic	4pF 50V CH
C294	Ceramic	0.001µF 50V
C296	Tantalum	10µF 16V DN
C297	Electrolytic	47µF 6.3V RC2
C298	Ceramic	0.001µF 50V
C299	Tantalum	1.5µF 25V DN
C300	Ceramic	0.001µF 50V
C301	Ceramic	0.001µF 50V
C302	Ceramic	0.001µF 50V
C303	Electrolytic	10µF 16V RC2
C304	Electrolytic	10µF 16V RC2
C305	Ceramic	470pF 50V
C306	Ceramic	470pF 50V
C307	Ceramic	0.001µF 50V
C308	Ceramic	470pF 50V
C309	Ceramic	0.001µF 50V
C310	Ceramic	0.001µF 50V
C311	Ceramic	0.001µF 50V
C312	Ceramic	0.001µF 50V
C313	Ceramic	470pF 50V
C314	Ceramic	0.001µF 50V
C315	Ceramic	10pF 50V
C316	Ceramic	470pF 50V
J201	Connector	TNC102-N1-W1-L1
J202	Connector	HSJ-1102-01-040
J203	Connector	HSJ-0836-01-010
J204	Connector	HEC-0747-01-010
J205	Connector	171255-1
J206	Connector	171255-1

[PLL UNIT]

REF. NO.	DESCRIPTION	PART NO.
EP201	P.C. Board	B-1318B
EP202	Vinyl Tube	d=5 L=4mm
EP203	Vinyl Tube	d=2 L=105mm
EP204	Vinyl Tube	d=2 L=50mm
EP205	Irrax Tube	d=0.7 L=3mm
EP206	Crystal Seat	41590
EP207	Irrax Tube	d=0.7 L=8mm
EP210	F.P.C. Board	B-1050A
EP211	F.P.C. Board	B-1044
EP212	Irrax Tube	d=0.7 L=3mm
W201	Shield Cable	66/99/115/W18/W18
W202		08
W203	Wire	23/03/080/W02/W02
W204	Jumper	JPW-02A
W205	Wire	72/98/015/X98/X98
W206	Shield Cable	66/99/060/W18/W18
W207		08
W208	Wire	23/04/050/D21/D21
W209	Wire	23/05/040/D21/D21

8-3 DISPLAY UNIT

REF. NO.	DESCRIPTION	PART NO.	
IC601	IC	μPD7225G	
D601	Diode	1SS193	
D602	Diode	1SS193	
D603	Diode	1SS193	
D604	Diode	1SS193	
R601	Chip	180kΩ	MCR10
R602	Chip	10kΩ	MCR10
R603	Chip	10kΩ	MCR10
R604	Chip	10kΩ	MCR10
C601	Ceramic	470pF	50V
C602	Monolithic	470pF	GRM40
C603	Monolithic	470pF	GRM40
C604	Monolithic	0.001μF	GRM40
C605	Monolithic	47pF	GRM40
C606	Monolithic	47pF	GRM40
C607	Monolithic	47pF	GRM40
C608	Monolithic	0.001μF	GRM40
C609	Monolithic	0.001μF	GRM40
C610	Monolithic	0.001μF	GRM40
DS601	Lamp	BQ031-22403A	
DS602	LCD	LR-580-E	
MC601	Microphone	KUC-2023-01-006	
SP601	Speaker	40P-157B	
EP601	Rubber Conductor	SRCN-411	
EP603	P.C. Board	B-1453B	(DISPLAY)
EP604	F.P.C. Board	B-1046A	
EP606	Irrax Tube	d=0.7 L=4mm	
W601	Wire	23/04/050/W01/W01	
W602	Wire	23/00/040/W01/W01	
W603	Wire	23/02/050/W01/W01	
W604	Wire	23/07/050/W01/W01	
W605	Wire	23/00/040/W01/W01	

8-4 LOGIC UNIT (#01, #02, #03)

REF. NO.	DESCRIPTION	PART NO.	
IC701	IC	μPD78C06AG-570-12	
IC702	IC	SC-1073	
IC703	IC	μPD446G	
IC704	IC	μPD74HC42G	
IC705	IC	μPD74HC125G	
IC706	IC	μPD4066BG	
IC707	IC	MX503	
IC708	IC	MX003	
IC709	IC	μPD4094BG	
IC710	IC	S-7116A	
IC711	IC	μPD4069UBG	
Q701	Transistor	2SA1162 Y	
Q702	Transistor	RN2404	
Q703	Transistor	2SC2712 Y	
Q704	Transistor	RN1404	
D701	Zener	RD5.1M B2	
D702	Diode	1SS181	
D703	Diode	1SS181	
D704	Diode	1SS184	
D705	Diode	1SS184	
D706	Diode	1SS184	
D708	Diode	1SS181	
X701	Crystal	FAGNKD	
X702	Crystal	FAANKD	
R701	Chip	27kΩ	MCR10
R702	Chip	22kΩ	MCR10
R703	Chip	22kΩ	MCR10
R704	Chip	270kΩ	MCR10
R705	Chip	1kΩ	MCR10
R706	Chip	1MΩ	MCR10
R707	Chip	12kΩ	MCR10
R708	Chip	12kΩ	MCR10
R709	Chip	12kΩ	MCR10
R710	Chip	12kΩ	MCR10
R711	Chip	47kΩ	MCR10
R712	Chip	1MΩ	MCR10
R713	Chip	47kΩ	MCR10
R714	Chip	47kΩ	MCR10
R715	Chip	10kΩ	MCR10
R716	Chip	4.7kΩ	MCR10
R717	Chip	47kΩ	MCR10
C701	Monolithic	0.01μF	GRM40 F
C702	Tantalum	0.1μF	35V DN
C703	Tantalum	2.2μF	16V DN
C704	Monolithic	0.01μF	GRM40 F
C705	Monolithic	0.001μF	GRM40
C706	Monolithic	0.01μF	GRM40 F
C707	Monolithic	0.01μF	GRM40 F
C708	Monolithic	30pF	GRM40
C709	Monolithic	30pF	GRM40
C710	Monolithic	0.01μF	GRM40 F
C711	Monolithic	0.01μF	GRM40 F

[LOGIC UNIT (#01, #02, #03)]

REF. NO.	DESCRIPTION	PART NO.	
C712	Monolithic	0.01μF	GRM40 F
C713	Monolithic	0.01μF	GRM40 F
C714	Monolithic	0.01μF	GRM40 F
C715	Monolithic	0.01μF	GRM40 F
C716	Monolithic	18pF	GRM40
C717	Monolithic	18pF	GRM40
C718	Barrier Layer	0.01μF	25V
C719	Monolithic	47pF	GRM40
C720	Monolithic	220pF	GRM40
C721	Monolithic	470pF	GRM40
C722	Monolithic	470pF	GRM40
C723	Monolithic	470pF	GRM40
C724	Monolithic	470pF	GRM40
C725	Monolithic	470pF	GRM40
C726	Monolithic	470pF	GRM40
C727	Monolithic	470pF	GRM40
C728	Monolithic	470pF	GRM40
C729	Monolithic	470pF	GRM40
C730	Monolithic	470pF	GRM40
C731	Monolithic	470pF	GRM40
C732	Monolithic	470pF	GRM40
C733	Monolithic	220pF	GRM40
J701	Connector	IMSA-9201B-2-02-T	
P701	Connector	IMSA-9201B-HT	
EP701	P.C. Board	B-1316F	(LOGIC)

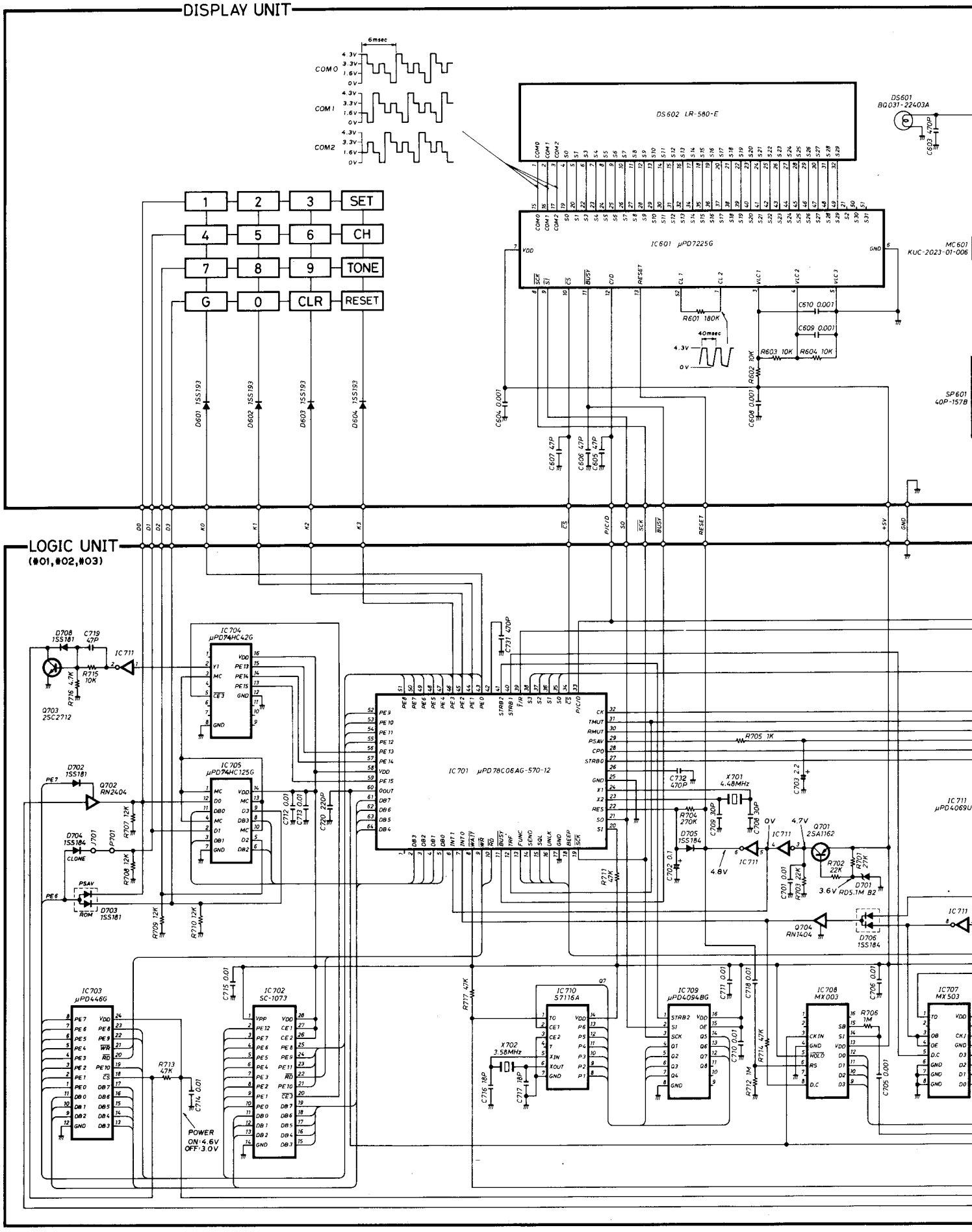
8-5 LOGIC-A UNIT (#11, #12, #13, #14, #15, #16, #17, #18, #19)

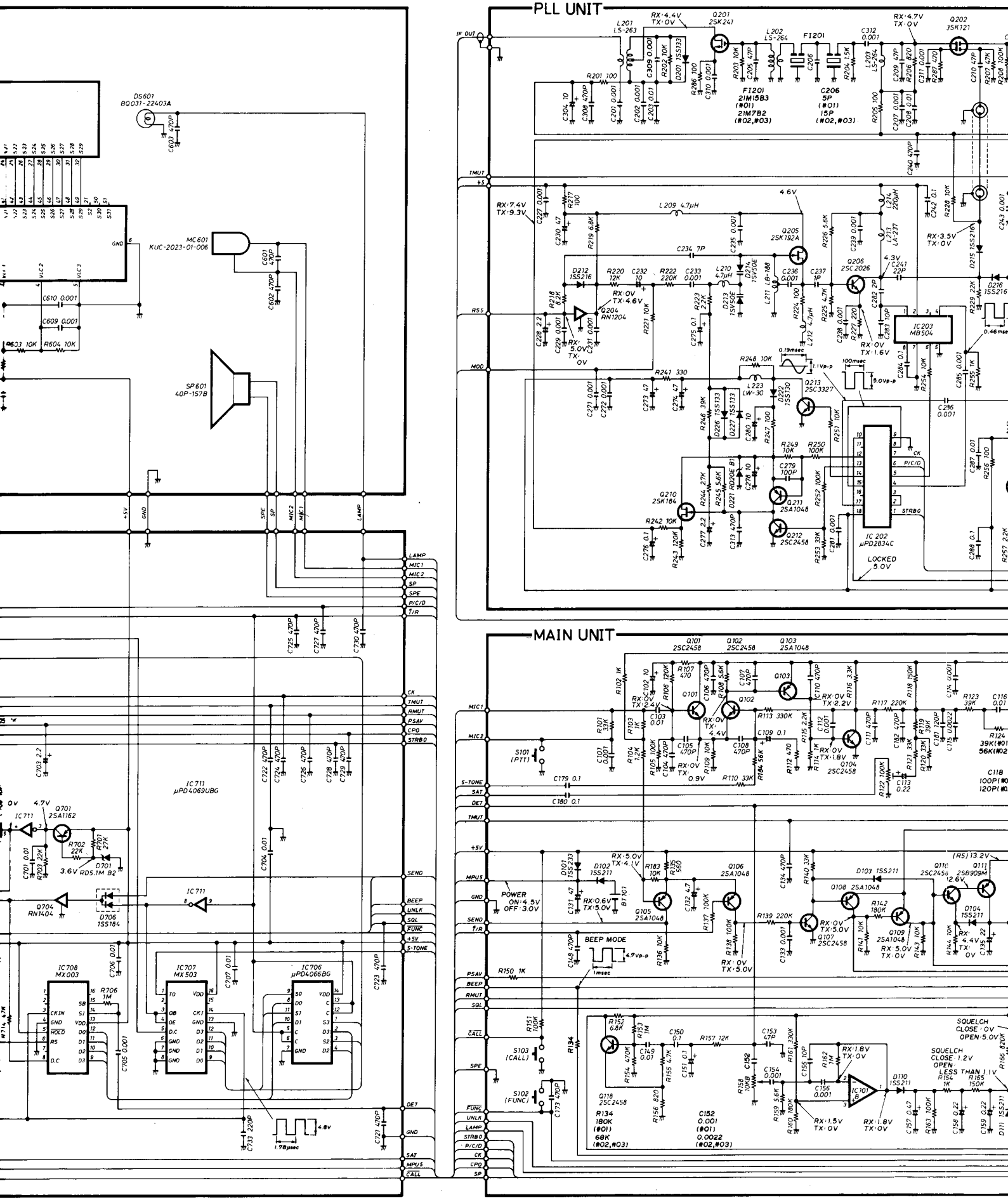
REF. NO.	DESCRIPTION	PART NO.	
IC701	IC	μPD78C06AG-570-12	
IC702	IC	SC-1085	
IC703	IC	μPD446G	
IC704	IC	S7116A	
IC705	IC	SC-1084 (#11, #12, #14, #15, #16, #17, #18, #19) SC-1093 (#13)	
IC706	IC	FX-102LG	
IC707	IC	TC4SU69 F	
Q701	Transistor	2SA1162 Y	
Q702	Transistor	RN2404	
Q703	Transistor	2SC2712 Y	
Q704	Transistor	RN2404	
Q705	Transistor	RN1404	
D701	Zener	RD5.1M B2	
D702	Diode	1SS184	
D703	Diode	1SS181	
D704	Diode	1SS184	
D705	Diode	1SS184	
D706	Diode	1SS184	
D707	Diode	1SS184	
D708	Diode	ISS133	
D709	Diode	ISS133	
X701	Crystal	FAGNKD	
X702	Crystal	FAANKD	
R701	Chip	27kΩ	MCR10
R702	Chip	22kΩ	MCR10
R703	Chip	22kΩ	MCR10
R704	Chip	270kΩ	MCR10
R705	Chip	1kΩ	MCR10
R706	Chip	2.2MΩ	MCR10
R707	Chip	47kΩ	MCR10
R708	Chip	12kΩ	MCR10
R709	Chip	12kΩ	MCR10
R710	Chip	12kΩ	MCR10
R711	Chip	12kΩ	MCR10
R712	Chip	47kΩ	MCR10
R713	Chip	100kΩ	MCR10
R714	Chip	100kΩ	MCR10
R715	Chip	100kΩ	MCR10
R716	Chip	47kΩ	MCR10
R717	Chip	47kΩ	MCR10
R718	Chip	47kΩ	MCR10
R719	Chip	47kΩ	MCR10
R720	Chip	47kΩ	MCR10
R721	Chip	10kΩ	MCR10
R722	Chip	4.7kΩ	MCR10
R723	Chip	47kΩ	MCR10
R724	Chip	15kΩ	MCR10
R725	Chip	4.7kΩ	MCR10
R726	Resistor	2.7kΩ	R10

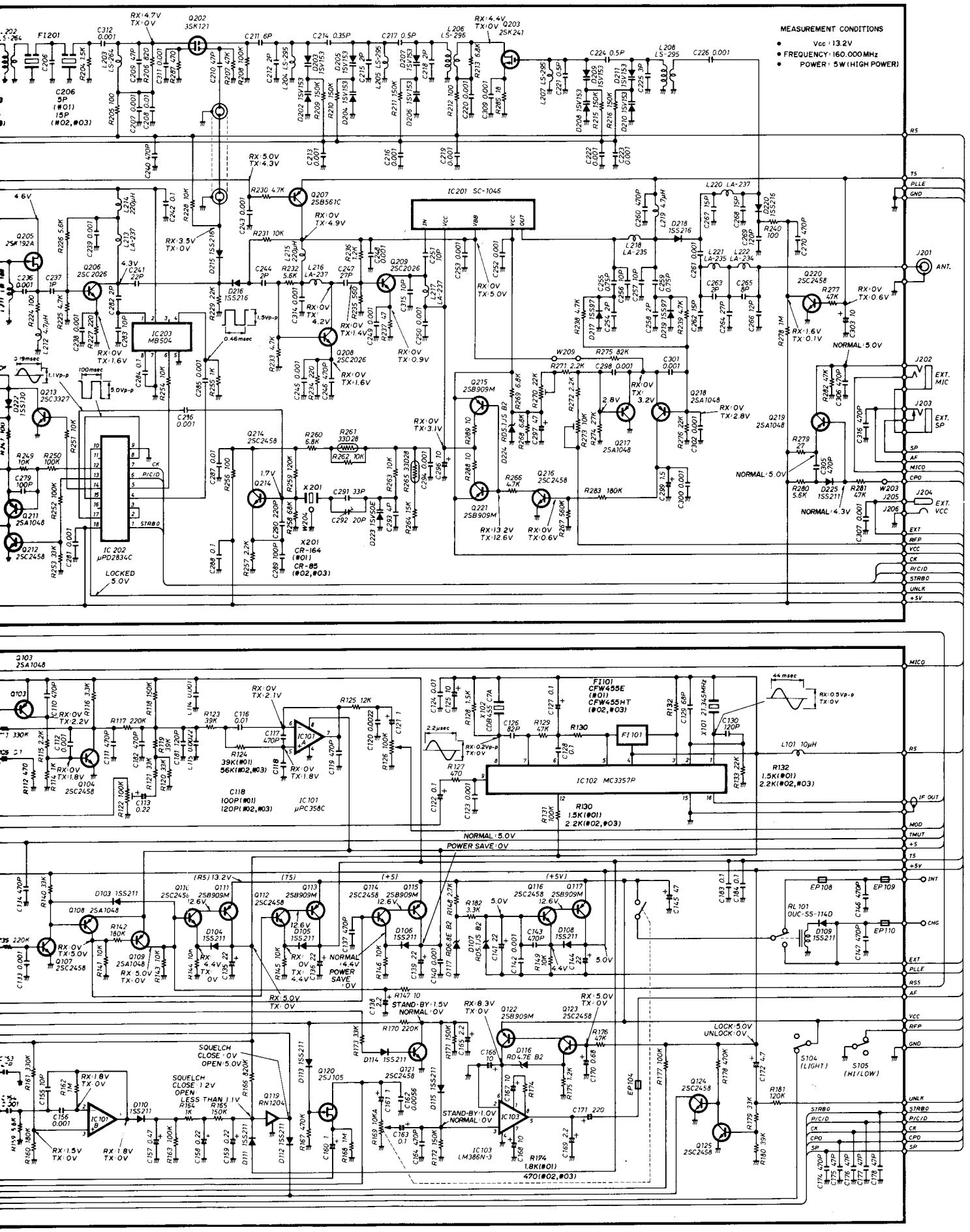
[LOGIC-A UNIT (#11, #12, #13, #14, #15, #16, #17, #18, #19)]

REF. NO.	DESCRIPTION	PART NO.	
C701	Monolithic	0.01μF	GRM40 F
C702	Monolithic	0.01μF	GRM40 F
C703	Monolithic	0.1μF	GRM40 F
C704	Monolithic	470pF	GRM40
C705	Monolithic	470pF	GRM40
C706	Tantalum	2.2μF	16V DN
C707	Monolithic	470pF	GRM40
C708	Monolithic	470pF	GRM40
C709	Monolithic	470pF	GRM40
C710	Monolithic	470pF	GRM40
C711	Monolithic	470pF	GRM40
C712	Monolithic	470pF	GRM40
C713	Monolithic	470pF	GRM40
C714	Monolithic	0.01μF	GRM40 F
C715	Monolithic	0.01μF	GRM40 F
C716	Monolithic	0.0022μF	GRM40
C717	Monolithic	18pF	GRM40
C718	Monolithic	18pF	GRM40
C719	Monolithic	470pF	GRM40
C720	Monolithic	10pF	GRM40
C721	Monolithic	30pF	GRM40
C722	Monolithic	0.01μF	GRM40 F
C723	Monolithic	470pF	GRM40
C724	Monolithic	470pF	GRM40
C725	Monolithic	0.01μF	GRM40 F
C726	Monolithic	0.01μF	GRM40 F
C727	Monolithic	0.01μF	GRM40 F
C728	Monolithic	0.01μF	GRM40 F
C729	Monolithic	0.01μF	GRM40 F
C730	Monolithic	470pF	GRM40
C731	Monolithic	47pF	GRM40
C732	Tantalum	4.7μF	16V DN
J701	Connector	IMSA-9201B-2-02T	
P701	Connector	IMSA-9201B-HT	
EP701	P.C. Board	B-1580B	(LOGIC-A)

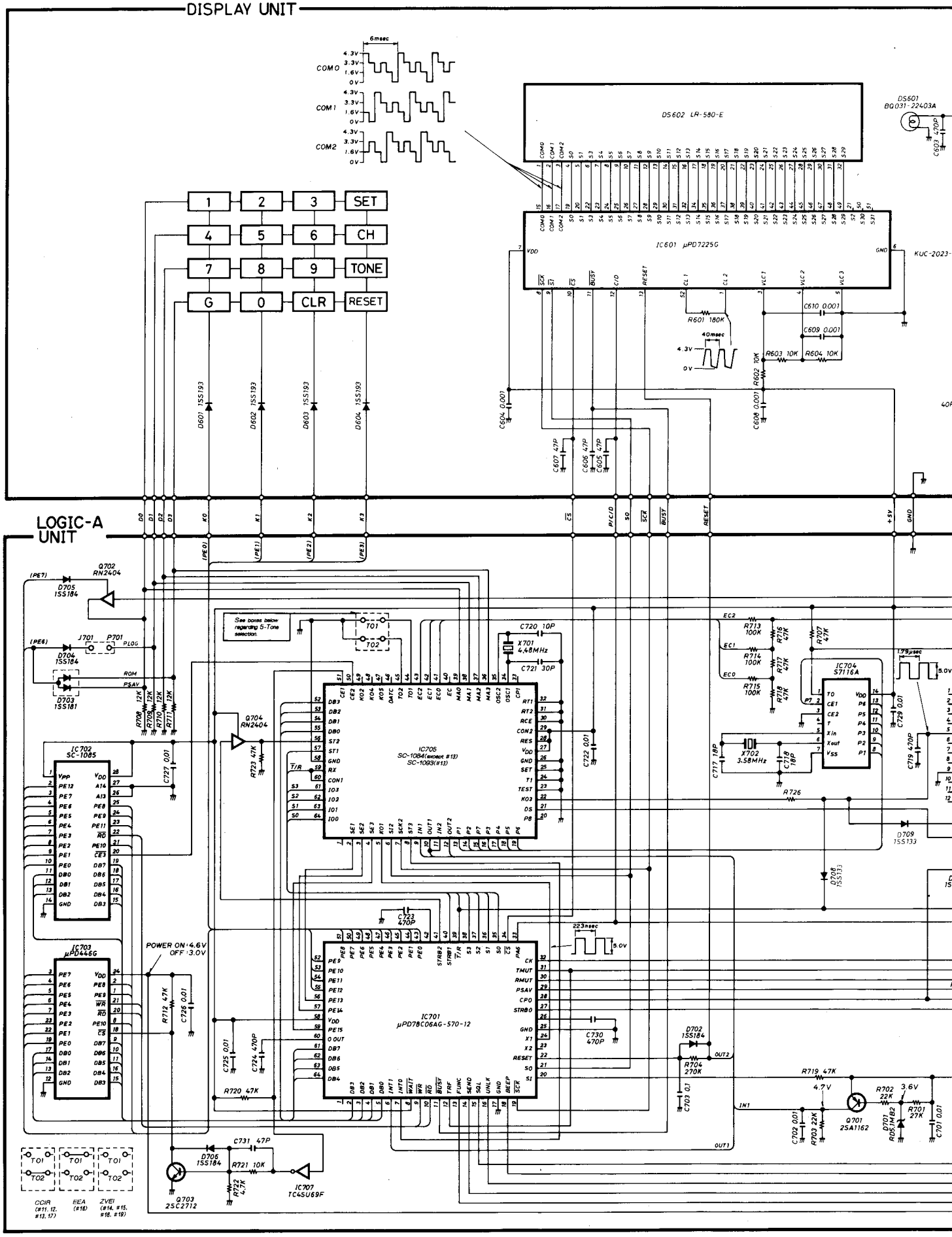
■ VERSION #01~#03

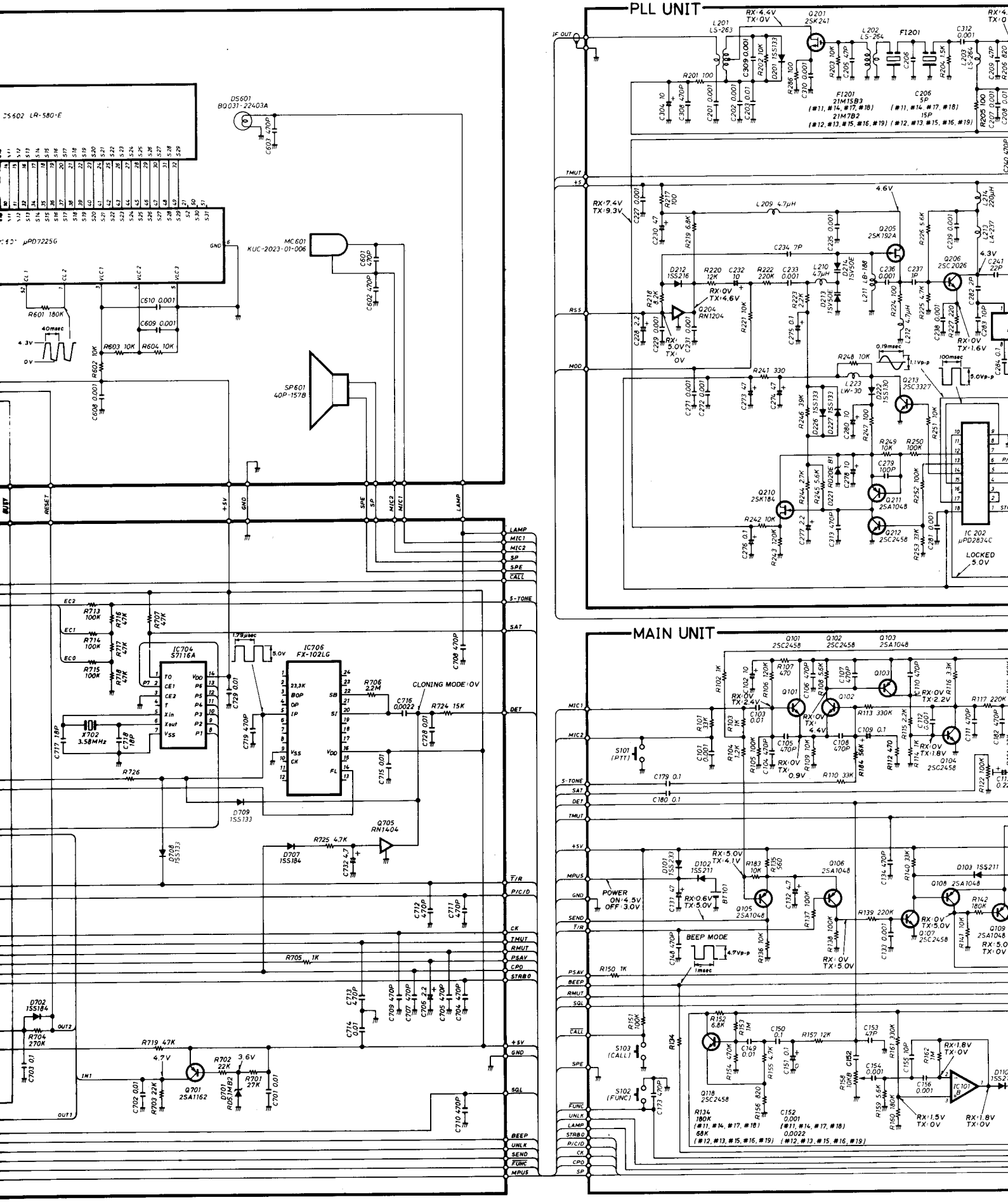


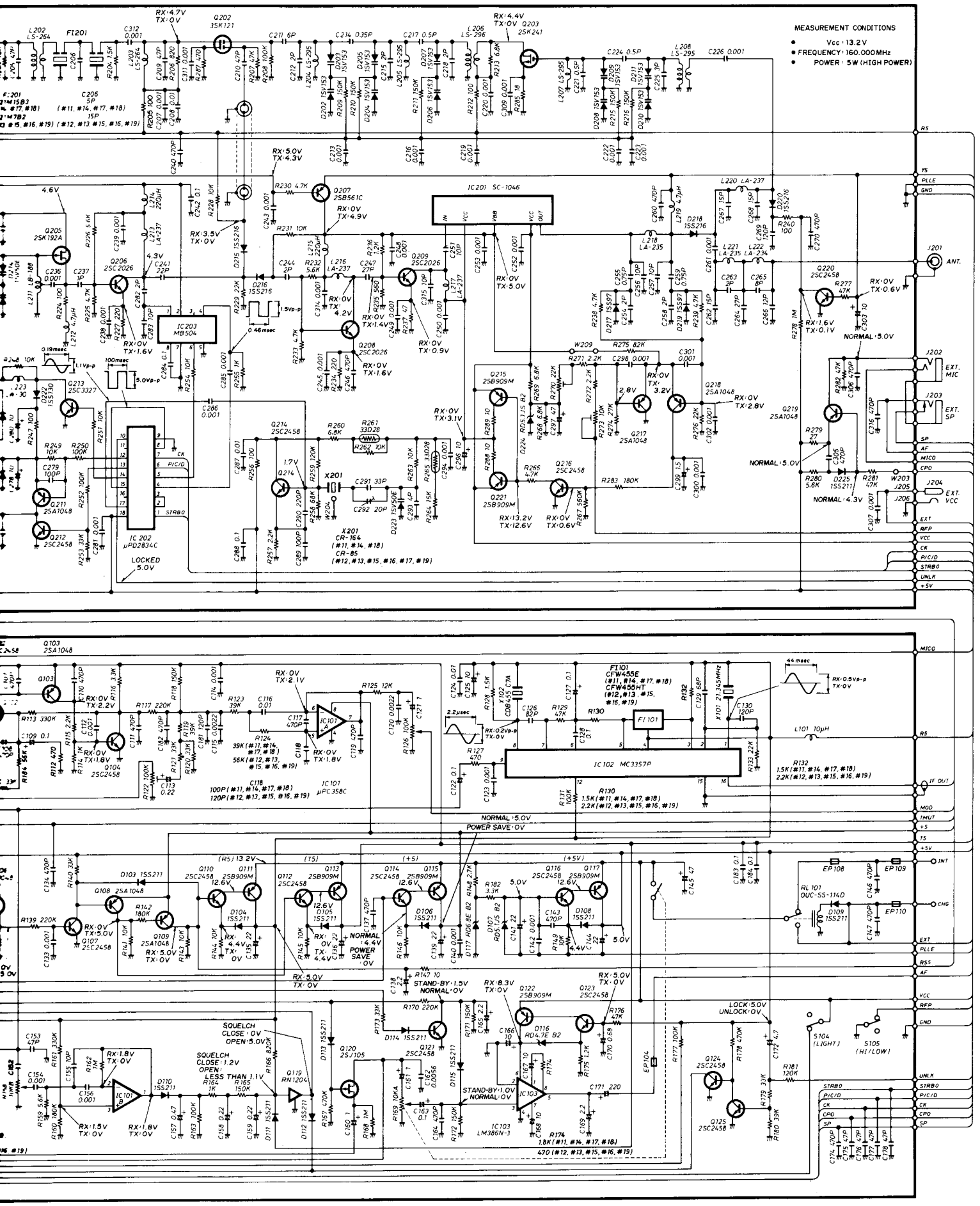

PLL UNIT
MAIN UNIT
DS601
BQ031-22403A
MC601
KUC-2023-01-006
SP601
40P-1578
IC711
μPD4069UBG
IC708
MX003
IC707
MX503
IC706
μPD4066BG
IC202
μPD2834C
IC203
MB504
Q201
2SK241
Q202
3SK121
Q204
RN1204
Q205
2SK192A
Q206
2SC2026
Q210
2SK184
Q211
2SA1048
Q212
2SC2458
Q213
2SC3327
Q701
2SA1162
Q704
RN1404
Q101
2SC2458
Q102
2SC2458
Q103
2SA1048
Q104
2SC2458
Q105
2SA1048
Q106
2SA1048
Q107
2SC2458
Q108
2SA1048
Q109
2SA1048
Q110
2SC2458
Q111
2SB909M
Q118
2SC2458
D212
1SS216
D213
1SV50E
D214
1SV50E
D215
1SS216
D216
1SS216
D701
RD5.1M B2
D706
1SS184
D101
1SS233
D102
1SS211
D103
1SS211
D104
1SS211
D110
1SS211
D111
1SS211
IC101
IC 1.8V
IF OUT
TMUT
+5
RSS
MOD
+5V
GND
SPE
SP
MIC2
MIC1
LAMP
CK
P/C/D
STRB0
LOCKED
5.0V
MIC1
MIC2
S-TONE
SAT
DET
MPUS
SEND
BEEP
UNLK
SQL
FUNC
CALL
RMUT
PSAV
CPO
S101
(PTT)
S102
(FUNC)
S103
(CALL)
POWER
ON:4.5V
OFF:3.0V
BEEP MODE
SQUELCH
CLOSE:1.2V
OPEN:
LESS THAN 1.1V
SQUELCH
CLOSE:0V
OPEN:5.0V
FI201
21M15B3
(#01)
21M7B2
(#02,#03)
C206
5P
(#01)
15P
(#02,#03)
C152
0.001
(#01)
0.0022
(#02,#03)
R134
180K
(#01)
68K
(#02,#03)


MEASUREMENT CONDITIONS
• Vcc : 13.2V
• FREQUENCY : 160.000MHz
• POWER : 5W (HIGH POWER)
IC201 SC-1046
IC 202 μPD2834C
IC203 MB504
IC 101 μPC358C
IC102 MC3357P
IC103 LM386N-3
X201
CR-164 (#01)
CR-85 (#02,#03)
F1101
CFW455E (#01)
CFW455HT (#02,#03)
FI101
X101 21.345MHz
LOCKED 5.0V
NORMAL : 5.0V
NORMAL : 4.3V
POWER SAVE : 0V
STAND-BY : 1.5V
STAND-BY : 1.0V
LOCK : 5.0V
UNLOCK : 0V
SQUELCH CLOSE : 0V OPEN : 5.0V
SQUELCH CLOSE : 1.2V OPEN : LESS THAN 1.1V
J201 ANT.
J202 EXT. MIC
J203 EXT. SP
J204 EXT. VCC
J205
J206
S104 (LIGHT)
S105 (HI/LOW)
RL101 OUC-SS-114D
EP104
EP108
EP109
EP110
R5
TS
PLLE
GND
SP
AF
MICO
CPO
RFP
VCC
CK
P/C/D
STRBO
UNLK
+5V
IF OUT
MOD
TMUT
INT
CHG
EXT
RSS

■ VERSION #11~#19




PLL UNIT
MAIN UNIT
IC704 S7116A
IC706 FX-102LG
IC 202 μPD2834C
MC601 KUC-2023-01-006
SP601 40P-157B
DS601 BQ031-22403A
μPD7225G
CLONING MODE:0V
BEEP MODE
POWER ON:4.5V OFF:3.0V
LOCKED 5.0V
LAMP
MIC1
MIC2
SP
SPE
CALL
5-TONE
SAT
DET
TMUT
+5V
MPUS
GND
SEND
T/R
PSAV
BEEP
RMUT
SQL
FUNC
UNLK
STRB0
P/C/D
CK
CPO
RESET
BUSY


MEASUREMENT CONDITIONS
Vcc : 13.2V
FREQUENCY : 160.000MHz
POWER : 5W (HIGH POWER)
IC201 SC-1046
IC203 MB504
IC 202 μPD2834C
LOCKED 5.0V
X201 CR-164 (#11, #14, #18) CR-85 (#12, #13, #15, #16, #17, #19)
FI101 CFW455E (#11, #14, #17, #18) CFW455HT (#12, #13, #15, #16, #19)
IC102 MC3357P
IC101 μPC358C
IC103 LM386N-3
RL101 OUC-SS-1140
S104 (LIGHT)
S105 (HI/LOW)
NORMAL : 5.0V
POWER SAVE : 0V
STAND-BY : 1.5V
STAND-BY : 1.0V
SQUELCH CLOSE : 0V OPEN : 5.0V
SQUELCH CLOSE : 1.2V OPEN : LESS THAN 1.1V
LOCK : 5.0V UNLOCK : 0V
J201 ANT.
J202 EXT. MIC
J203 EXT. SP
J204 EXT. VCC
MIC0
RS
IF OUT
MOD
TMUT
+5
TS
+5V
INT
CHG
EXT
PLLE
RSS
AF
VCC
RFP
GND
UNLK
STRB0
P/C/D
CK
CPO
SP

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