

The ICOM logo consists of a small circle above the letter 'I', followed by the letters 'COM' in a bold, sans-serif font.

# SERVICE MANUAL

430 MHz FM TRANSCEIVER

**IC-449A**

**IC-449E**

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Icom Inc.

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## INTRODUCTION

This service manual describes the latest information for the following transceivers at the time of publication.

MODEL	VERSION NO.	VERSION	SYMBOL
IC-449A	#05	U.S.A.	USA
	#07	Australia	AUS
IC-449E	#02	Europe	EUR

To upgrade quality, all electrical or mechanical parts and internal circuits are subject to change without notice or obligation.

## DANGER

**NEVER** connect the transceiver to an AC outlet or to a DC power supply that uses more than 16 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.



## 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>

115000010 IC SC1019 IC-449A/E MAIN UNIT 5 pieces  
8810006010 Screw FH M3×5 ZK BS IC-449A/E Top cover 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.

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# SECTION 1 SPECIFICATIONS

## ■ GENERAL

● Frequency coverage

MODEL	VERSION	RECEIVER	TRANSMITTER
IC-449A	U.S.A.	440.000~450.000 MHz	440.000~450.000 MHz
	Australia	430.000~440.000 MHz	430.000~440.000 MHz
IC-449E	Europe	430.000~440.000 MHz	430.000~440.000 MHz

● Mode

: F3 (FM)

● Selectable tuning step (Initial)

: 5, 10, 12.5, 15, 20, 25 kHz or 1 MHz

● Memory channels

: 20 plus 1 call channel

● Antenna impedance

: 50 Ω (unbalanced)

● Power supply requirement

: 13.8 V DC ± 15% (negative ground)

● Current drain

: Receive 500 mA (squelched)  
800 mA (max. audio output)  
: Transmit 4.0 A (LOW 1), 5.0 A (LOW 2), 7.0 A (LOW 3), 9.5 A (HIGH)

● Usable temperature range

: -10°C ~ +60°C (+14°F ~ +140°F)

● Frequency stability

: ±10 ppm (-10°C ~ +60°C; +14°F ~ +140°F)

● Dimensions

: 140 (W) × 40 (H) × 155 (D) mm; 5.5 (W) × 1.6 (H) × 6.1 (D) in  
(Projections not included)

● Weight

: 1.0 kg (2.2 lb)

## ■ TRANSMITTER

● Output power

: 35 W (HIGH), 20 W (LOW 3), 10 W (LOW 2), 5 W (LOW 1)

● Modulation system

: Variable reactance frequency modulation

● Max. frequency deviation

: ±5 kHz

● Spurious emissions

: Less than -60 dB

● Microphone impedance

: 600 Ω

## ■ RECEIVER

● Receive system

: Double-conversion superheterodyne

● Intermediate frequencies

: 1st 30.875 MHz  
2nd 455 kHz

● Sensitivity

: Less than 0.16 μV for 12 dB SINAD

● Selectivity

: More than 15 kHz/-6 dB  
Less than 30 kHz/-60 dB

● Audio output power

: More than 2.4 W at 10% distortion with an 8Ω load

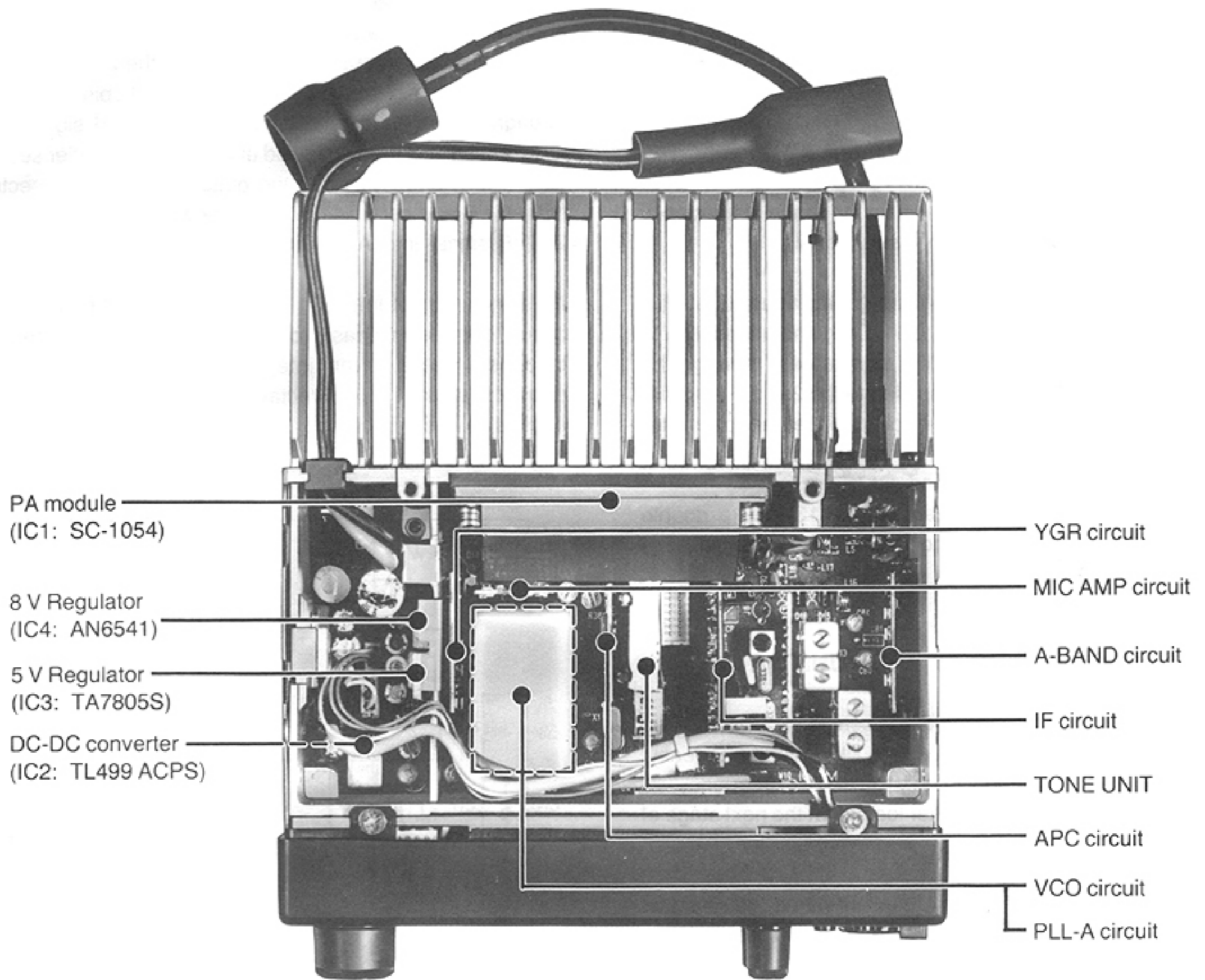
● Audio output impedance

: 4~8 Ω

All stated specifications are subject to change without notice or obligation.



## SECTION 2 INSIDE VIEWS



## SECTION 3 CIRCUIT DESCRIPTION

### 3-1 RECEIVER CIRCUITS

#### 3-1-1 ANTENNA SWITCHING CIRCUIT (MAIN UNIT)

The antenna switching circuit switches the transmit/receive circuit and functions as a low-pass filter while receiving and as a resonator circuit while transmitting.

Received signals enter the antenna connector and pass through a low-pass filter (L4, L5, C27, C28, C31). The signals are applied to an antenna switching circuit (D2, D15, D16) and then to an RF circuit via the bandpass filter (L16~L18, C86~C90, C92).

#### 3-1-2 RF CIRCUIT (MAIN UNIT)

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

The signals from the antenna switching circuit pass through a one-stage bandpass filter (L15, C84, C85) and are applied to an RF amplifier (Q20). Then, the signals pass through the bandpass filter (L13), and are applied to the 2nd RF amplifier (Q19). Amplified signals are re-applied to the bandpass filter (L12) and are applied to the 1st mixer (Q17).

The coils in the bandpass filters (L12, L13) use a double tuned helical coil. They have good bandpass characteristics and eliminate signals outside of the range.

#### 3-1-3 1ST MIXER CIRCUIT (MAIN UNIT)

The 1st mixer circuit converts the received signal to a fixed frequency of the 1st IF signal using a PLL output frequency. By varying the PLL frequency, only the desired frequency will be passed through the crystal filter located at the next stage of the 1st mixer.

The signals from the RF circuit are mixed with a 1st LO signal from the VCO circuit to produce a 30.875 MHz 1st IF signal.

#### 3-1-4 1ST IF CIRCUIT (MAIN UNIT)

The 1st IF circuit amplifies a signal which is converted in the 1st mixer circuit.

After passing through a matching circuit (L8, C63), the 1st IF signal is applied to a pair of crystal filters (F11) to suppress out-of-band signals. The 1st IF signal is amplified at an IF amplifier (Q22) and then enters a demodulator circuit.

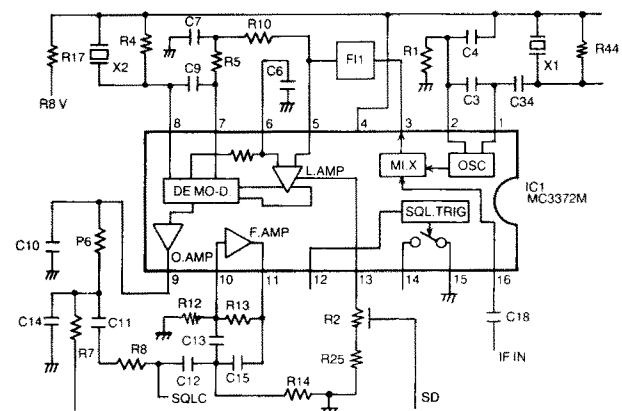
#### 3-1-5 2ND IF CIRCUIT (IF UNIT)

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

The 1st IF signal from Q22 is applied to a 2nd mixer section of IC1 (pin 16), is mixed with a 2nd LO signal using X1 and is converted to a 455 kHz 2nd IF signal.

IC1 contains the 2nd mixer, the local oscillator, the limiter amplifier and quadrature detector circuits. The local oscillator section and X1 generates 30.42 MHz for the 2nd LO signal. The 2nd IF signal from the 2nd mixer (IC1, pin 3) passes through a ceramic filter (F11) where unwanted signals are suppressed. 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) to demodulate the 2nd IF signal into AF signals.

AF signals output from IC1 (pin 9) are applied to a squelch circuit and de-emphasis circuit (Q6, Q7, etc.). The de-emphasis circuit is an integrated circuit with frequency characteristics of  $-6$  dB/octave. The resulting signals are applied to the AF circuit.



IF CIRCUIT

#### 3-1-6 SQUELCH CIRCUIT (IF UNIT)

The squelch circuit cuts out AF signals when no RF signal is received. By detecting noise components in the AF signals, the squelch circuit switches the AF control circuits.

Some of the noise components in the AF signals from IC1 (pin 11) are applied to IC1 (pin 13). The [SQL] control (R41) on the LOGIC UNIT adjusts the IC1 (pin 13) input level.

The active filter section in IC1 amplifies noise components of frequencies of 20 KHz and above and outputs the resulting signal from IC1 (pin 14). Output signals are rectified by D2 and are converted to DC voltage.

The DC voltage triggers the squelch switch (Q1). The signal is applied to the CPU (IC4, pin 18) on the LOGIC UNIT through the SQLS signal line.

### **3-1-7 AF CIRCUIT (MAIN UNIT)**

The AF circuit amplifies the signals to drive a speaker. The AF circuit includes a mute circuit to mute a signal with a noise squelch.

The [VOL] control on the LOGIC UNIT adjusts the signals which pass through the detector mute switch (Q23), the BEEP signal and the DTMF monitor signal. The AF signals, the BEEP signal and the DTMF monitor signal are then amplified at the AF amplifier (IC8) to obtain the speaker driving level.

The AF mute transistor (Q24) cuts the input signal of the AF amplifier (IC8) when the transceiver is transmitting or the squelch is closed. If an external speaker is connected, the internal speaker is automatically disconnected.

## **3-2 TRANSMITTER CIRCUITS**

### **3-2-1 MICROPHONE AMPLIFIER (MIC AMP AND VCO UNITS)**

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

AF signals from the microphone pass through the mute switch (Q27) and are amplified at the microphone preamplifier (Q1) through the "MIC IN" line. IC1a includes a low level amplifier with pre-emphasis and a limiter amplifier. The amplified signals from IC1a pass through a low-pass filter (IC1b) and are then applied to the VCO circuit.

### **3-2-2 MODULATION CIRCUIT (MIC AMP AND VCO UNIT)**

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

Audio signals from the MIC AMP UNIT (MIC OUT signal) change the reactance of varactor diodes (D1, D2) to modulate the oscillated signal at Q1. The oscillated signal is buffer-amplified at Q2 and is then applied to the drive amplifier circuit.

### **3-2-3 DRIVE AMPLIFIER CIRCUIT (YGR UNIT)**

The drive amplifier circuit amplifies the VCO oscillating signal.

The VCO output (OUT1) is buffer-amplified at Q1 on the MAIN UNIT and is applied to the receive/transmit switching circuit (D1, D12). Then, the VCO output is amplified at the predriver (Q1) and the drive amplifier (Q2). Q2 is controlled by a collector current of Q2 on the MAIN UNIT.

### **3-2-4 POWER AMPLIFIER CIRCUIT (MAIN UNIT)**

The power amplifier circuit amplifies the drive signal.

RF signals from the driver amplifier (Q2) are applied to IC1 (pin 1). IC1 is a power module and amplifies the signals to approximately 35 W. The output signal from IC1 (pin 5) is applied to a switching diode (D2) and then to a low-pass filter (L4, L5, C27, C28, C31). The low-pass filter attenuates unwanted harmonic signals.

### **3-2-5 ANTENNA SWITCHING CIRCUIT (MAIN UNIT)**

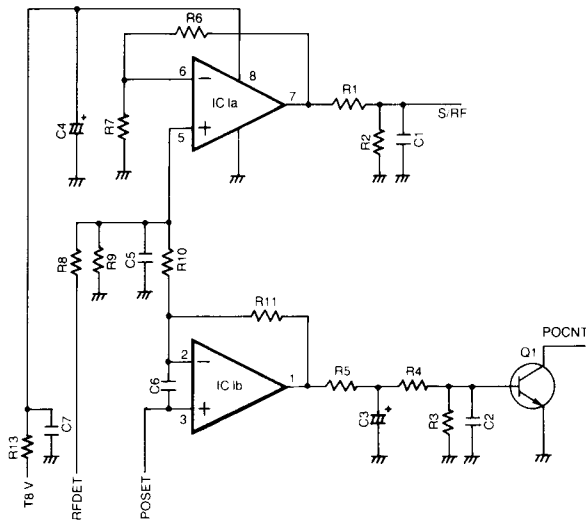
An antenna switching circuit applies the received signal to a receiver circuit and the transmitter signal to the antenna connector.

When transmitting, the switching diodes (D2, D15, D16) are turned ON by a signal from T8V. RF signals from IC1 which are not applied to the receiver circuit are applied to the antenna connector through the low-pass filter.

### **3-2-6 APC CIRCUIT (APC UNIT)**

An APC circuit protects the power module from a mismatched output load and selects HIGH or LOW output power. The "RFDET" voltage, generated in the APC detector (D3, D4, L5, R17, R18, R20, R22, C28, C31) on the MAIN UNIT, is applied to the APC amplifiers (IC1a, IC1b).

The amplified voltage from IC1b is applied to Q1. IC1a is an RF meter amplifier. The output voltage (POCNT line) from Q1 is applied to Q11 to control the RF output power.



**APC CIRCUIT**

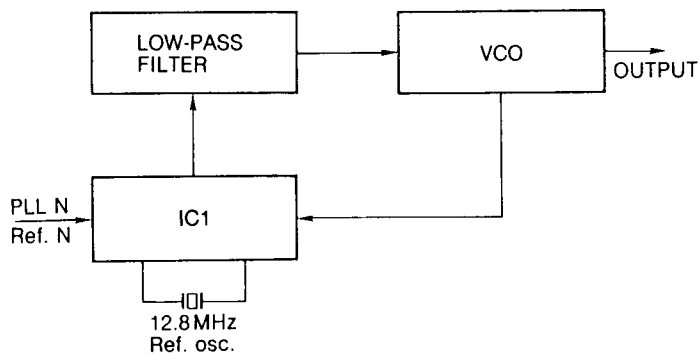
### 3-2-7 POWER CONTROL CIRCUIT (MAIN UNIT)

The power control circuit (Q10, Q11) selects one of three output power levels (HIGH, LOW-2, LOW-1, LOW-0) and controls output voltage from the APC circuit (POSET line).

## 3-3 PLL CIRCUITS

### 3-3-1 GENERAL

The PLL circuit steadily oscillates the transmit frequency and the receive local frequency. The PLL output frequency is controlled by the divided ratio of the programmable divider.



**PLL CIRCUIT BLOCK DIAGRAM**

### 3-3-2 REFERENCE OSCILLATOR (MAIN UNIT)

The reference oscillator circuit oscillates the PLL reference frequency.

A reference frequency (12.8 MHz) is produced by X1. The reference frequency is adjusted by C7.

### 3-3-3 VCO CIRCUIT (VCO UNIT)

A VCO circuit generates receive and transmit frequencies and produces FM modulation.

The VCO circuit forms a Colpitts oscillator circuit (Q1). Strip lines are used for stable oscillation over a wide frequency range. Varactor diodes (D1, D2) provide frequency control. The buffer-amplifier (Q2) is unaffected by VCO oscillation and is applied to the PLL IC (IC1, pin 1) on the PLL-A UNIT.

### 3-3-4 PROGRAMMED DIVIDER AND PHASE DETECTOR CIRCUITS (PLL-A UNIT)

The programmable divider shifts the dividing ratio with a prescaler depending on the operating frequency and determines the VCO oscillating frequency. The phase detector circuit detects the off-phase components of the VCO frequency using a stable reference frequency.

IC1 is a one-chip PLL IC that contains a dual modulus prescaler, a swallow counter, a programmable divider and a phase detector.

In IC1, the entered signal is divided at a prescaler and at programmable divider sections. A reference frequency is also divided at a divider section. Both of the divided signals are compared at a phase detector section to output their differential components.

### 3-3-5 CHARGE PUMP AND LOOP FILTER CIRCUIT (PLL UNIT)

These circuits convert the phase-detected signal to DC voltage.

An active loop filter (Q1, Q2) converts the phase-detected signal (pulse signal) to DC voltage (PLL lock voltage) to control the VCO oscillating signal. The PLL lock voltage changes the reactance of varactor diodes in the VCO circuit.

## 3-4 LOGIC CIRCUITS

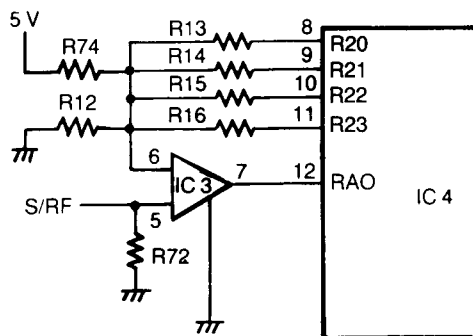
### 3-4-1 S/R/F INDICATOR CIRCUIT

The "S/R/F" signal coming from the MAIN UNIT is applied to the meter comparator (IC3, pin 5). IC3 (pin 6) receives a counting signal from the CPU (IC4, pins 8~11).

IC3 (pin 7) becomes "HIGH" when the counting signal is lower than the "S/R/F" signal and becomes "LOW" when the counting signal is higher than the "S/R/F" signal.

When IC3 (pin 7) becomes "LOW," the CPU detects that the signal strength level is the same as the counting signal level and displays the counting signal on the LCD.

When transmitting, the LCD displays the selected RF power level regardless of the input signal strength.



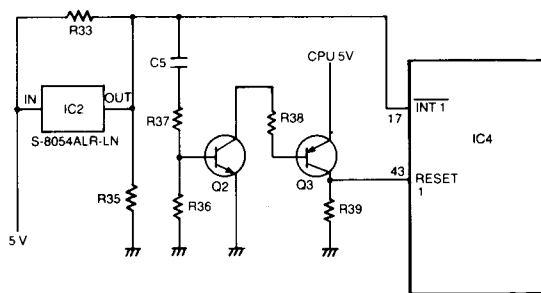
**S/RF INDICATOR CIRCUIT**

**3-4-2 CPU RESET CIRCUIT (LOGIC UNIT)**

IC2 detects voltage in the 5 V line. When the 5 V line becomes higher than the threshold voltage of IC2, the CPU reset circuit outputs “HIGH” as the interrupt signal.

While holding the [SET] and [MW] switches and turning ON the power, the reset port of the CPU (IC4, pin 43) becomes “HIGH”. When the port receives “HIGH,” the CPU is initialized.

When the 5 V line becomes lower than the threshold voltage of IC2, the INT1 port of the CPU (pin 17) becomes “LOW”, and the CPU enters the standby condition.



**RESET CIRCUIT**

**3-4-3 SUBAUDIBLE TONE CIRCUIT (LOGIC UNIT)**

IC4 encodes subaudible tone frequency signals of 88.5 MHz. This signal is output from IC4 (pin 50) and passes through a low-pass filter (Q7, R67~R69, C19~C21). Then, the signal is applied to the MAIN UNIT.

**3-4-4 CPU PORT ALLOCATIONS (LOGIC UNIT)**

PORT NO.	PIN NO.	TERMINAL NAME	DESCRIPTION
D1	49	STBPL	Outputs a PLL strobe signal.
D2	50	S TONE	Outputs a signal for 88.5 Hz tone.
D3	51	BEEP	Outputs a signal for beep tone.
R01~R03	1~3	KEYS0~KEYS2	Output a strobe signal for the initial matrix.
R10~R13	4~7	KEY10~KEY13	Input ports for the initial matrix.
R20~R23	8~11	SRFO0~SRFO3	Output counting signals for the S-indicator.
R30	14	DIAL UP	Input port for the up signal of the main dial.
R31	15	DIAL DN	Input port for the down signal of the main dial.
R32	16	INT0/DIAL CK	Input port for the main dial up/down clock.
R33	17	INT1/BACKUP	Input port for the signal of memory backup.
R40	27	SCK	Outputs clock signals for the serial data (SO).
R41	28	SI	Inputs serial data.
R42	29	SO	Outputs serial data.
R43	30	P/S	Outputs a strobe signal for the data expander (IC6 on the MAIN UNIT).
R50	18	SQLS	Detects a squelch signal. When the signal is “HIGH,” the squelch opens.
R52	20	UNLK	Detects a PLL unlock signal. When the signal is “HIGH,” the PLL is unlocked. Normally, the port is “LOW.”
R60~R62	22~24	STBCC STBOT STBOD	Output signals for controlling the STB selector (IC7, J6 and J7 on the MAIN UNIT.)
R63	25	CE(LCD)	Outputs a signal for LCD driver selection.
R70	31	MIC U/D	Input port for the microphone up/down signal.
R71	32	MIC CK	Input port for the microphone clock.
R72	33	MW	This port becomes low when the [MW] switch is pushed.
R73	34	MONI	This port becomes low when the [MONI] switch is pushed.
R80	35	SET	This port becomes low when the [SET] switch is pushed.
R81	36	HI/LOW	This port becomes low when the [HI/LOW] switch is pushed.
R82	37	PGR/CS	This port becomes low when the [PGR/CS] switch is pushed.
R83	38	T/TSQL	This port becomes low when the [T/TSQL] switch is pushed.
R90	39	DUP	This port becomes low when the [DUP] switch is pushed.
R91	40	PRI0	This port becomes low when the [PRI0] switch is pushed.
R92	41	M/CALL	This port becomes low when the [M/CALL] switch is pushed.
R93	42	V/M	This port becomes low when the [V/M] switch is pushed.

PORT NO.	PIN NO.	TERMINAL NAME	DESCRIPTION
RA0	12	SRFI	Inputs a signal from the meter comparator.
RA1	13	PTT	Inputs a signal on the PTT line. This port becomes "HIGH" when the PTT switch is pushed.
RESET	43	RESET INPUT	When a "HIGH" signal is applied here, the CPU either is initialized or changes to standby mode.
OSC1	45		Input port for the oscillator of the CPU clock.
OSC2	46		Output port for the oscillator of the CPU clock.
GND	47		Ground.
VCC	26		Input port for the power source of the CPU.

### 3-4-5 I/O EXPANDER IC PORT ALLOCATIONS

#### IC7 SHIFT REGISTER (MAIN UNIT)

PORT NO.	PIN NO.	TERMINAL NAME	DESCRIPTION																				
Q1	4	DETMUTE	Becomes "HIGH" when the detector signal is muted.																				
Q2	5	AFMUTE	Becomes "HIGH" when the AF amplifier input is muted.																				
Q3	6	MICMUTE	Becomes "HIGH" when the mic amplifier input is muted.																				
Q4	7	AF SW	Becomes "LOW" when the SET MODE display is "AF-H."																				
Q5	14	RXATT	Becomes "LOW" when the SET MODE display is "Att.oFF."																				
Q6~Q8	11~13	Low0~Low2	For setting RF output power. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>LPo-1</th> <th>LPo-2</th> <th>LPo-3</th> <th>HI</th> </tr> </thead> <tbody> <tr> <td>Low 0</td> <td>H</td> <td>L</td> <td>L</td> <td>L</td> </tr> <tr> <td>Low 1</td> <td>L</td> <td>H</td> <td>L</td> <td>L</td> </tr> <tr> <td>Low 2</td> <td>L</td> <td>L</td> <td>H</td> <td>L</td> </tr> </tbody> </table>		LPo-1	LPo-2	LPo-3	HI	Low 0	H	L	L	L	Low 1	L	H	L	L	Low 2	L	L	H	L
	LPo-1	LPo-2	LPo-3	HI																			
Low 0	H	L	L	L																			
Low 1	L	H	L	L																			
Low 2	L	L	H	L																			

#### IC5 SHIFT REGISTER (MAIN UNIT)

PORT NO.	PIN NO.	TERMINAL NAME	DESCRIPTION															
Q1	4	TX	Becomes "HIGH" when transmitting.															
Q3~Q4	6~7	DM1~DM2	For setting the LCD dimmer. (Level 3 is brightest.) <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Level</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>DM1</td> <td>L</td> <td>H</td> <td>L</td> <td>H</td> </tr> <tr> <td>DM2</td> <td>L</td> <td>L</td> <td>H</td> <td>H</td> </tr> </tbody> </table>	Level	0	1	2	3	DM1	L	H	L	H	DM2	L	L	H	H
Level	0	1	2	3														
DM1	L	H	L	H														
DM2	L	L	H	H														

#### IC6 P/S SHIFT REGISTER (MAIN UNIT)

PORT NO.	PIN NO.	TERMINAL NAME	DESCRIPTION
QA	7	TSQLS	Becomes "HIGH" when an optional tone squelch is open.
QB	6	UNIT.T	Becomes "LOW" when an optional UT-50 TONE SQUELCH UNIT is connected.
QC	5	UNIT.D	Becomes "LOW" when an optional UT-55 DTMF ENCODER/DECODER UNIT is connected.
QD	4	STD	Stands up while DTMF is decoding.
QE	13	D0	DTMF decode data. (4 bits)
QF	14	D1	DTMF decode data. (4 bits)
QG	15	D2	DTMF decode data. (4 bits)
QH	1	D3	DTMF decode data. (4 bits)

### 3-5 OTHER CIRCUITS

#### 3-5-1 REGULATOR CIRCUIT (MAIN UNIT)

IC4 is a 3-terminal voltage regulator IC chip. +13.8 V is applied to the input terminal. The output terminal outputs a regulated +9 V (8 V line) to each unit.

IC3 is a 3-terminal voltage regulator IC chip. +13.8 V is applied to an input terminal and the output terminal outputs +5.5 V (5 V line) using D7.

#### 3-5-2 DC-DC CONVERTER (MAIN UNIT)

A DC-DC converter consisting of IC2, Q4 and D5 creates approximately 20 V DC from 5 V DC to obtain wide range lock voltage for the PLL circuits.

#### 3-5-3 CPU POWER SUPPLY CIRCUIT (LOGIC UNIT)

When the power switch is turned OFF, voltage is applied to the CPU (IC4, pin 26) via D11 from the lithium backup battery installed in the transceiver to provide backup power for the memory contents.

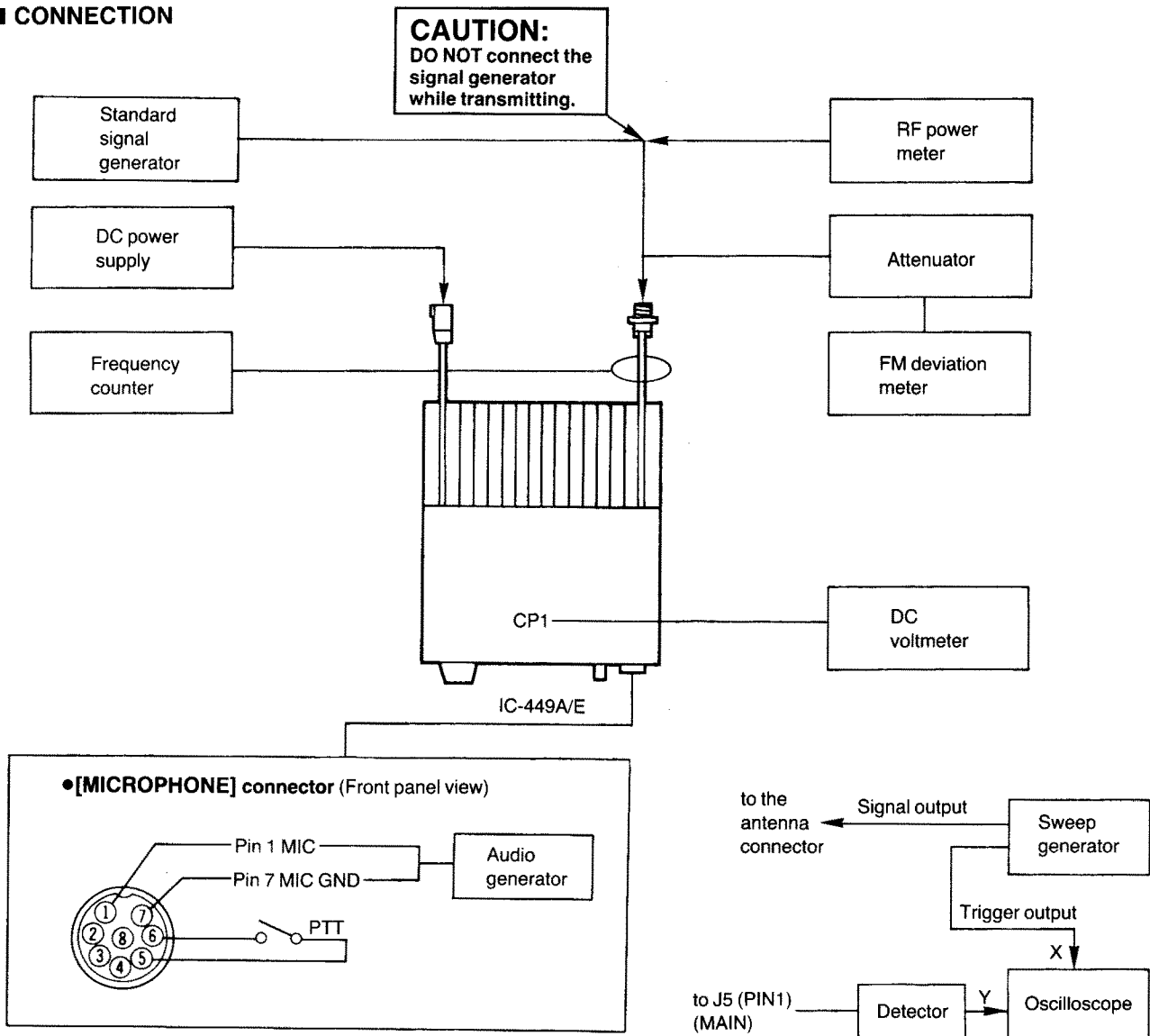
# SECTION 4 ADJUSTMENT PROCEDURES

## 4-1 PREPARATION BEFORE SERVICING

### ■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.8 V DC ± 15% Current capacity : 15 A or more	Audio generator (AG)	Frequency range : 300~3000 Hz Output range : 2~200 mV
RF power meter (terminated type)	Measuring range : 1~60 W Frequency range : 120~450 MHz Input impedance : 50 Ω SWR : 1.2 : 1 or better	FM deviation meter	Frequency range : 0.1~460 MHz Measuring range : 0~±10 kHz
Frequency counter	Frequency range : 0.1~460 MHz Frequency accuracy : 1 ppm or better Sensitivity : 100 mV or better	Sweep generator	Frequency range : 0.1~460 MHz Sweep bandwidth : At least 10 MHz Output impedance : 50 Ω
Attenuator	Attenuation : 40 dB or 50 dB Capacity : At least 60 W	Detector	
Standard signal generator (SSG)	Frequency range : 0.1~460 MHz Output level : -127~-17 dBm (0.1 μV~32 mV)	DC voltmeter	Input impedance : 50 kΩ/V DC or better

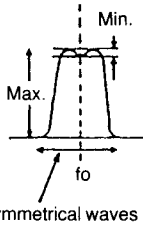

### ■ CONNECTION



## 4-2 PLL ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
REFERENCE FREQUENCY	1 <ul style="list-style-type: none"> <li>●Frequency display: 435.000 MHz (AUS, EUR) 445.000 MHz (USA)</li> <li>●Connect the RF power meter to the antenna connector.</li> <li>●Simplex</li> <li>●Transmitting</li> </ul>	Rear panel	Loosely couple the frequency counter to the antenna connector.	435.000 MHz (AUS, EUR) 445.000 MHz (USA)	MAIN	C7

## 4-3 RECEIVER ADJUSTMENT

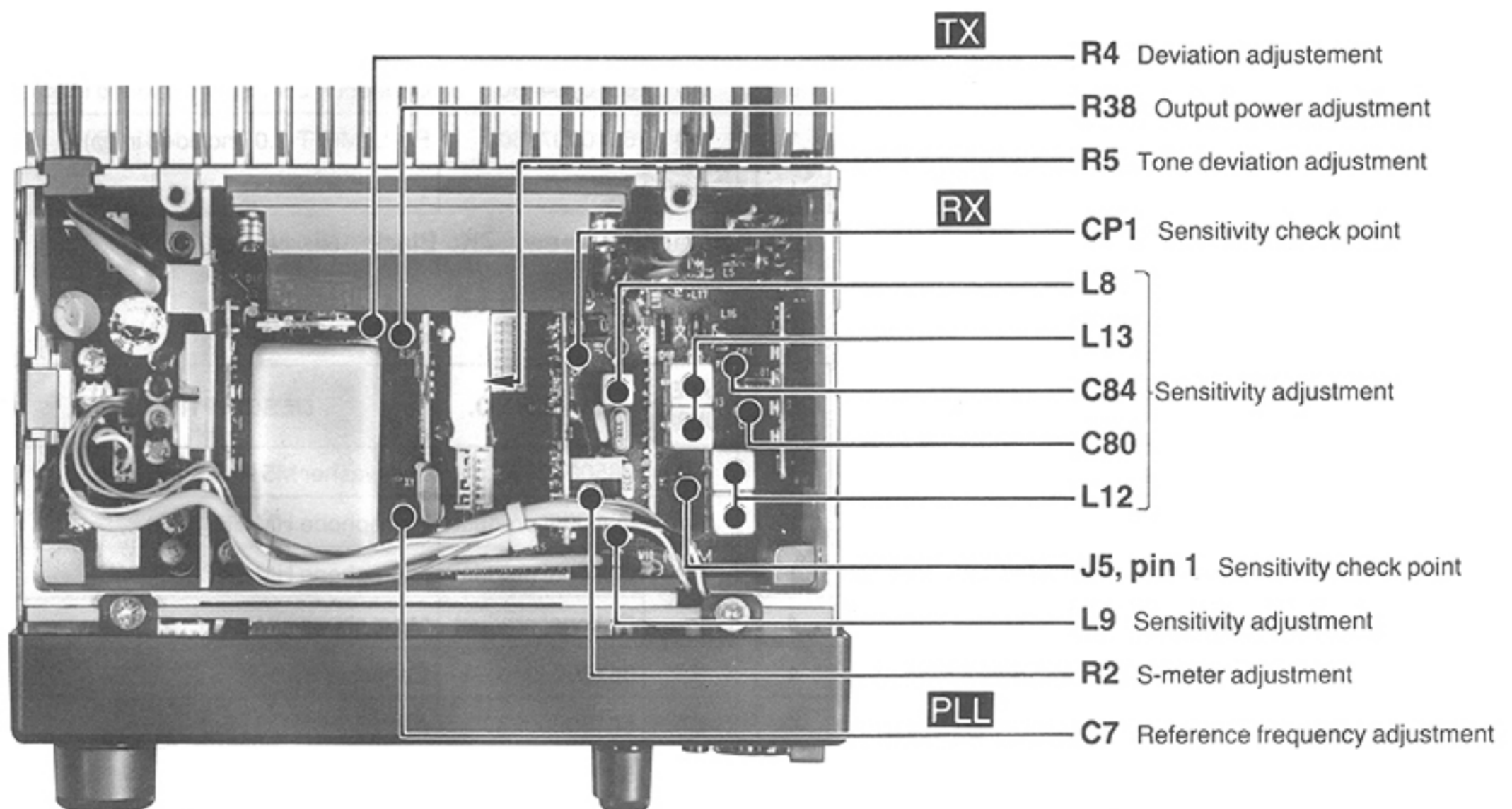
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
SENSITIVITY	1 <ul style="list-style-type: none"> <li>●Displayed frequency: 435.000 MHz (AUS, EUR) 445.000 MHz (USA)</li> <li>●Set the sweep generator to the antenna connector and set as: Sweep level: 22 mV* (-20 dBm) Center frequency: Same as the displayed frequency Sweep bandwidth: 10 MHz</li> <li>●Receiving</li> </ul>	MAIN	Connect the oscilloscope to J5 (pin 1) via the detector.	Adjust as follows:  Symmetrical waves	MAIN	Adjust in sequence C84 C80 L12 L13
	2 <ul style="list-style-type: none"> <li>●Set the SSG to the antenna connector and set as: Level : 3.16 μV* (-97 dBm) Mod. : 1 kHz Dev. : ±7 kHz</li> <li>●R2 : Max. clockwise</li> </ul>		Connect the DC voltmeter to CP1.	Maximum		
NOTE: Adjust the signal generator output level so that the DC voltmeter needle remains at all times in the lowest 30% of the full range.						
S-METER	1 <ul style="list-style-type: none"> <li>●Frequency display: 435.000 MHz (AUS, EUR) 445.000 MHz (USA)</li> <li>●Set the SSG to the antenna connector and set as: Level : 1 μV* (-107 dBm) Mod. : 1 kHz Dev. : ±3.5 kHz</li> <li>●Receiving</li> </ul>	Function display	S/RF indicator	S3 (4 dots) 	IF	R2

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



## 4-4 TRANSMITTER ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
OUTPUT POWER	1 <ul style="list-style-type: none"> <li>•Frequency display: 435.000 MHz (AUS, EUR) 445.000 MHz (USA)</li> <li>•[HI/LO] switch: HIGH</li> <li>•Transmitting</li> </ul>	Rear panel	Connect the RF power meter to the antenna connector.	35 W	MAIN	R38
DEVIATION	1 <ul style="list-style-type: none"> <li>•Frequency display: 435.000 MHz (AUS, EUR) 445.000 MHz (USA)</li> <li>•Set the audio generator to the [MICROPHONE] connector and set as: Level : 20 mV/1 kHz (AUS, EUR) 65 mV/1 kHz (USA)</li> <li>•Set the FM deviation meter as: HPF : 50 Hz LPF : 20 kHz De-emphasis : OFF Detector : (P-P)/2</li> <li>•TONE : OFF</li> <li>•Transmitting</li> </ul>	Rear panel	Connect the FM deviation meter to the antenna connector via the attenuator.	$\pm 4.8$ kHz	MAIN	R4
TONE DEVIATION (USA only)	1 <ul style="list-style-type: none"> <li>•Displayed frequency: 445.000 MHz</li> <li>•[T/T. SQL] switch : ON</li> <li>•Apply no signal to the [MICROPHONE] connector.</li> <li>•Set the tone frequency as: 88.5 Hz</li> <li>•Set the FM deviation meter as: HPF : OFF LPF : 20 kHz</li> <li>•Transmitting</li> </ul>	Rear panel	Connect the FM deviation meter to the antenna connector via the attenuator.	$\pm 0.8$ kHz	MAIN (TONE)	R5



## SECTION 5 MECHANICAL PARTS AND DISASSEMBLY

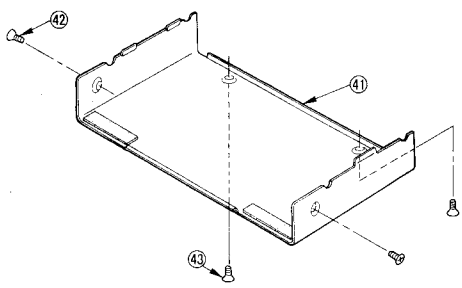
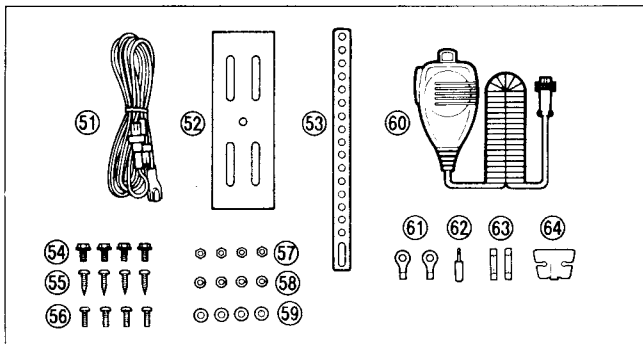
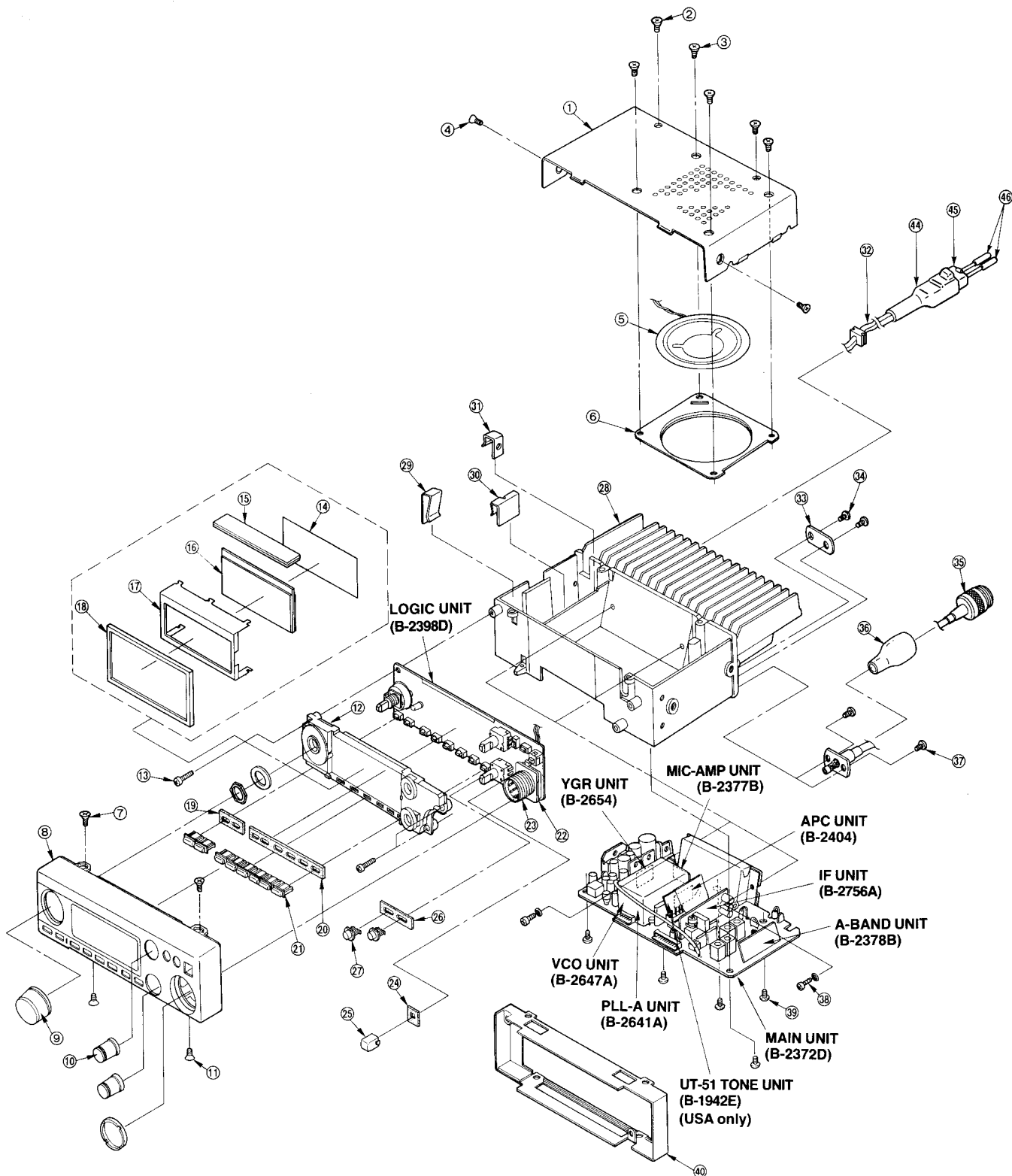
### 5-1 TRANSCEIVER

LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.	LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	8110004100	Top cover (incl. ③, ⑤, ⑥)	1	⑳	8310019961	Switch sheet-1	1
②	8810006010	Screw FH M3×5 BS	2	㉑	8610006530	Button K151	1
③	8810006230	Screw FH M2.6×4 ZK	4	㉒	8930017770	Switch sponge	1
④	8810006010	Screw FH M3×5 BS	2	㉓	8610006510	Button K152	2
⑤	2510000470	Speaker EAS-6P-100SA	1	㉔	8010009830	835 chassis	1
⑥	8930017810	833 Speaker holder	1	㉕	8930017940	AF-IC slider	1
⑦	8810002160	Screw FH M3×5	2	㉖	8930017930	IC-slider	1
⑧	8210005690	Front panel (IC-449A)	1	㉗	8930018520	TR-slider (A)	1
	8210005700	Front panel (IC-449E)	1	㉘	8900002640	Power supply cable OPC-250	1
⑨	8610006500	Knob N154 [MAIN DIAL]	1	㉙	8510006440	ANT plate	1
⑩	8610006490	Knob N153 [VOL, SQL]	2	㉚	8810001900	Screw FH M3×5 Ni BS	2
⑪	8810002160	Screw FH M3×5	2	㉛	8900001980	ANT cable OPC-188	1
⑫	8010009740	LCD reflector	1	㉜	6950000030	N-type cap (I)	1
⑬	8810000260	Screw PH M3×12	3	㉝	8810001900	Screw FH M3×5 Ni BS	2
⑭	8930017500	LCD filter	1	㉞	8810003250	Screw PH M3×8 Ni	2
⑮	8930017730	LCD contact strip SRCN-833-W	1	㉟	8810001350	Screw PH M3×6	5
⑯	5030000560	LCD LD-BU9496E	1	㊱	8510006450	LOGIC shield	1
⑰	8930017760	LCD holder	1	㊲	8110003880	Bottom cover	1
⑱	8930017690	LCD rubber	1	㊳	8810006010	Screw FH M3×5 BS	2
㉑	8930018350	Switch sponge (B)	1	㊴	8810006010	Screw FH M3×5 BS	2
㉒	8930018340	Switch sponge (A)	1	㊵	6950000130	Connector cover (included in ㉒)	2
㉓	8610006520	Button K150	8	㊶	6510004780	Connector LR-02-1V (included in ㉒)	1
㉔	8930012430	543 Mic spacer	1	㊷	6510007650	Pin LLM61T-2.0 (included in ㉒)	2
㉕	6510000290	Mic connector 8S-S-E	1				

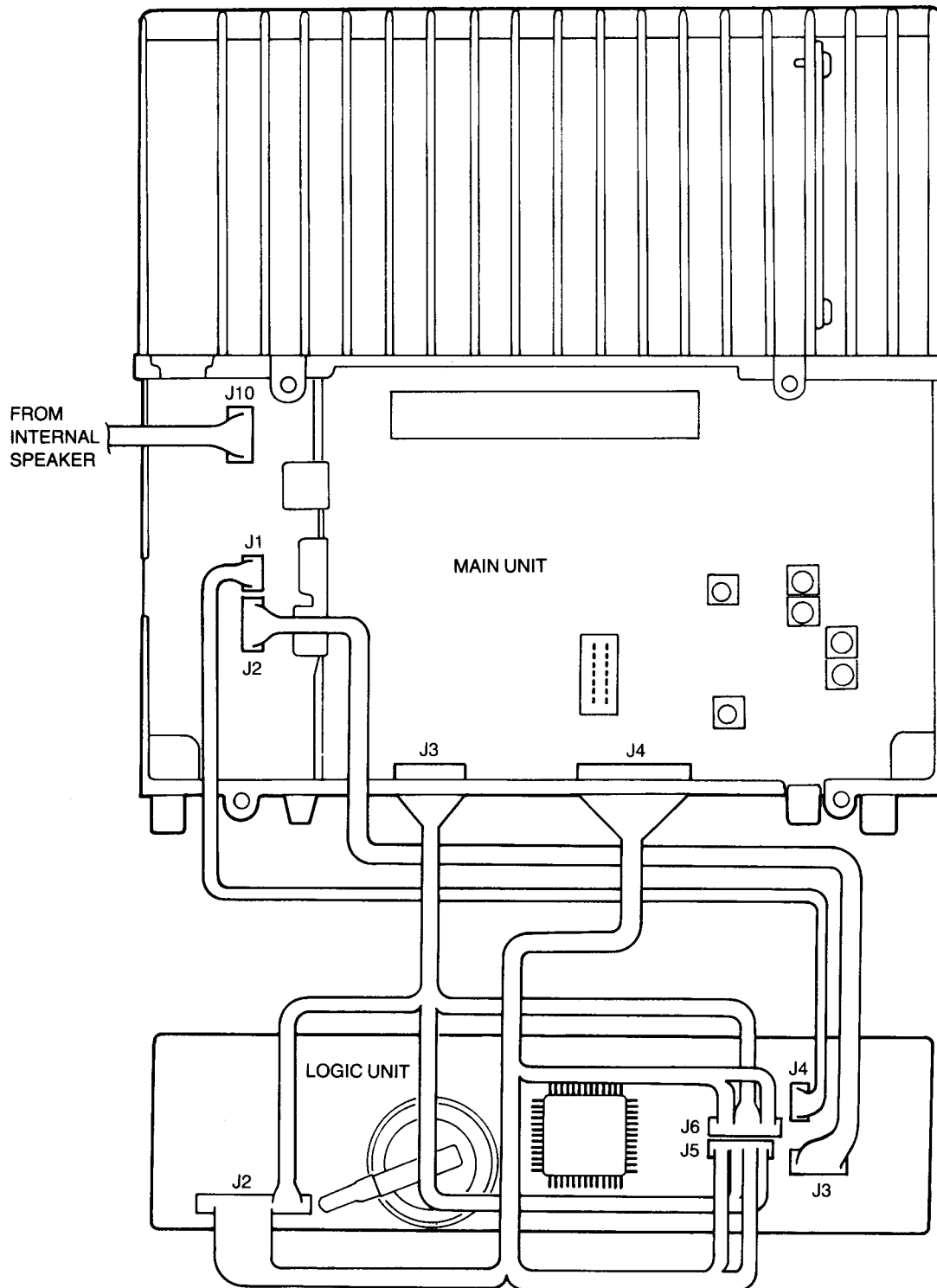
**Screw abbreviations** PH: Pan head FH: Flat head B0: Self-tapping screw ZK: Black Ni: Nickel

### 5-2 ACCESSORIES

LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.	LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
⑤①	Optional product	Power cable OPC-044B	1	⑤⑨	8850000150	Flat washer M5 Ni BS	4
⑤②	8010005180	Mounting bracket (B)	1	⑥⑩	Optional product	Microphone HM-56 (USA)	1
⑤③	8010004060	Mounting support bracket	1		Optional product	Microphone HM-58 (AUS)	1
⑤④	8820000530	Mounting bolt	4		Optional product	Microphone HM-59 (EUR)	1
⑤⑤	8810000950	Screw PH A M5×16	4	⑥①	6510003070	Cable lug R5.5-8	2
⑤⑥	8810000470	Screw PH M5×12 (+ -)	4	⑥②	5610000020	AP313 3.5∅ CS plug	1
⑤⑦	8830000120	Nut M5	4	⑥③	5210000120	Fuse FGP 15 A	2
⑤⑧	8850000440	Spring washer N5 Ni	4	⑥④	8930007300	Microphone hanger	1



# SECTION 6 CONNECTOR ASSEMBLY



# SECTION 7 PARTS LIST

## [LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1130004190	IC	LC7582A
IC2	1110001500	IC	S-8054ALR-LN-T1
IC3	1120000430	IC	LA6393M-TP-T1
IC4	1140001460	IC	HD404019A38FS
IC5	1130003920	IC	TC4S69F (TE85R)
Q1	1590000410	Transistor	RN2404 (TE85R)
Q2	1530000160	Transistor	2SC2712-Y (TE85RTEM)
Q3	1510000110	Transistor	2SA1162-Y (TE85R)
Q4	1530000160	Transistor	2SC2712-Y (TE85RTEM)
Q5	1530000160	Transistor	2SC2712-Y (TE85RTEM)
Q6	1530000160	Transistor	2SC2712-Y (TE85RTEM)
Q7	1530001950	Transistor	2SC2712-GR (TE85R)
D1	1750000040	Diode	1SS190(TE85R) (AUS)
	1750000030	Diode	1SS187(TE85R) (USA)
D2	1750000030	Diode	1SS187(TE85R) (EUR)
D3	1710000600	Diode	1SS254
D5	1710000600	Diode	1SS254 (EUR)
D6	1710000600	Diode	1SS254 (EUR)
D6	1710000600	Diode	1SS254 (USA)
D8	1750000050	Diode	1SS193(TE85R)
D10	1750000010	Diode	1SS181(TE85R)
D11	1750000050	Diode	1SS193(TE85R)
D12	1750000050	Diode	1SS193(TE85R)
D13	1730000840	Zener	RD9.1M-T2B2
D14	1750000050	Diode	1SS193(TE85R)
X1	6060000230	Crystal	FAR-C4CA-04194000-M01
R1	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R2	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R3	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R4	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R5	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R6	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R7	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R8	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R9	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R10	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R11	7030003600	Resistor	ERJ3GEYJ 223 V (22 kΩ)
R12	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R13	7030003760	Resistor	ERJ3GEYJ 474 V (470 kΩ)
R14	7030003720	Resistor	ERJ3GEYJ 224 V (220 kΩ)
R15	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R16	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R17	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R18	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R19	7030003600	Resistor	ERJ3GEYJ 223 V (22 kΩ)
R20	7030003600	Resistor	ERJ3GEYJ 223 V (22 kΩ)
R21	7030003800	Resistor	ERJ3GEYJ 105 V (1 MΩ)
R22	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R23	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R24	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R25	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R26	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R27	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R28	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R29	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R30	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)

## [LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R31	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R32	7030003650	Resistor	ERJ3GEYJ 563 V (56 kΩ)
R33	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R34	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R35	7030003720	Resistor	ERJ3GEYJ 224 V (220 kΩ)
R36	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R37	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R38	7030003440	Resistor	ERJ3GEYJ 102 V (1 kΩ)
R39	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R40	7210001870	Variable Resistor	EVU-F2AF20A14 (10KA) [VOL]
R41	7210001860	Variable Resistor	EVU-F2AF20B14 (10KB) [SQL]
R42	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R43	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R44	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R45	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R46	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R47	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R48	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R49	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R50	7030003580	Resistor	ERJ3GEYJ 153 V (15 kΩ)
R51	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R52	7030003800	Resistor	ERJ3GEYJ 105 V (1 MΩ)
R53	7030003480	Resistor	ERJ3GEYJ 222 V (2.2 kΩ)
R54	7030003560	Resistor	ERJ3GEYJ 103 V (10 kΩ)
R55	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R56	7030003480	Resistor	ERJ3GEYJ 222 V (2.2 kΩ)
R57	7030003600	Resistor	ERJ3GEYJ 223 V (22 kΩ)
R58	7030003560	Resistor	ERJ3GEYJ 103 V (10 kΩ)
R59	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R60	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R61	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R62	7030003440	Resistor	ERJ3GEYJ 102 V (1 kΩ)
R63	7030003320	Resistor	ERJ3GEYJ 101 V (100Ω)
R64	7030003600	Resistor	ERJ3GEYJ 223 V (22 kΩ)
R65	7030003840	Resistor	ERJ3GEYJ 225 V (2.2 MΩ)
R66	7030003840	Resistor	ERJ3GEYJ 225 V (2.2 MΩ)
R67	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R68	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R69	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R70	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R71	7030000140	Resistor	MCR10EZJH 10Ω (100)
R72	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R73	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R74	7030003580	Resistor	ERJ3GEYJ 153 V (15 kΩ)
R75	7030003350	Resistor	ERJ3GEYJ 181 V (180Ω)
R76	7030003350	Resistor	ERJ3GEYJ 181 V (180Ω)
C1	4030006830	Ceramic	C1608 SL 1H 331J-T-A
C2	4510001320	Electrolytic	6R3 MS5 47 μF
C3	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C4	4550000270	Tantalum	TESVA 1E 474M1-8L
C5	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C6	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C7	4510001320	Electrolytic	6R3 MS5 47 μF
C8	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C10	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C11	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C12	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C13	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C14	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C15	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C16	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C17	4030006860	Ceramic	C1608 JB 1H 102K-T-A

**[LOGIC UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION	
C18	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C19	4030006870	Ceramic	C1608 JB 1H 222K-T-A
C20	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C21	4030005090	Ceramic	C2012 JB 1H 223K-T-A
C22	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C23	4030006710	Ceramic	C1608 SL 1H 470J-T-A
C24	4030006710	Ceramic	C1608 SL 1H 470J-T-A
DS1	5030000560	LCD	LD-BU9496E (E-5141-4)
DS2	5080000150	LED	HRS-7219A
DS3	5080000150	LED	HRS-7219A
S1	2250000050	Encoder	EVQ-WQGF15 24B [MAIN DIAL]
S2	2230000550	Switch	SPPH23079A [POWER]
S3	2260000580	Switch	SKHLAD035A [V/MHz]
S4	2260000580	Switch	SKHLAD035A [M/CALL]
S5	2260000580	Switch	SKHLAD035A [PRIO]
S6	2260000580	Switch	SKHLAD035A [DUP]
S7	2260000580	Switch	SKHLAD035A [T/T.SQL]
S8	2260000580	Switch	SKHLAD035A [PGR/CS]
S9	2260000580	Switch	SKHLAD035A [HI/LO]
S10	2260000580	Switch	SKHLAD035A [SET]
S11	2260000580	Switch	SKHLAD035A [MONI]
S12	2260000580	Switch	SKHLAD035A [MW]
BT1	3020000020	Lithium Battery	BR2032-1T2
EP1	0910025304	P.C. Board	B 2398D (LOGIC)
EP2	8930017730	LCD contact strip	SRCN-833-W

**[MAIN UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION	
Q24	1530002550	Transistor	2SC3326-B (TE85R)
Q25	1530000160	Transistor	2SC2712-Y (TE85RTEM)
Q27	1590000520	FET	2SJ106-GR (TE85R)
Q28	1590000520	FET	2SJ106-GR (TE85R)
D1	1750000080	Diode	1SS153-T2
D2	1710000310	Diode	MI407
D3	1790000490	Diode	HSM88AS-TR
D4	1790000490	Diode	HSM88AS-TR
D5	1750000050	Diode	1SS193(TE85R)
D6	1750000050	Diode	1SS193(TE85R)
D7	1750000050	Diode	1SS193(TE85R)
D8	1790000700	Diode	DSA3A1
D9	1790000450	Diode	MA862(TX)
D10	1750000020	Diode	1SS184(TE85R)
D12	1750000080	Diode	1SS153-T2
D13	1750000020	Diode	1SS184(TE85R)
D14	1750000080	Diode	1SS153-T2
D15	1710000290	Diode	MI308
D16	1710000290	Diode	MI308
D17	1750000020	Diode	1SS184(TE85R)
D19	1750000070	Diode	1SS226(TE85R)
X1	6050006950	Crystal	CR-323
FI1	2010000230	Filter	30M15B (FL-76)
L1	6200000110	Coil	LQN 2A 33NM
L3	6170000230	Coil	LW-25
L4	6110001520	Coil	LA-232
L5	6110001520	Coil	LA-232
L6	6180002620	Coil	RCR664D-101K
L7	6180001120	Coil	FL 5H 101K
L8	6150003220	Coil	LS-320
L9	6150003220	Coil	LS-320
L11	6200001080	Coil	NL 322522T-015M
L12	6190000050	Coil	7HW-252MX-1550A
L13	6190000050	Coil	7HW-252MX-1550A
L14	6200001030	Coil	NL 322522T-012K
L15	6200000720	Coil	LQN 2A 10NM
L16	6110001530	Coil	LA-233
L17	6110001980	Coil	LA-222
L18	6110001520	Coil	LA-232
L19	6170000230	Coil	LW-25
R1	7030003470	Resistor	ERJ3GEYJ 182 V (1.8 kΩ) (EUR), (AUS)
	7030003570	Resistor	ERJ3GEYJ 123 V (12 kΩ) (USA)
R2	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ) (EUR), (AUS)
	7030003500	Resistor	ERJ3GEYJ 332 V (3.3 kΩ) (USA)
R3	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R4	4610001230	Trimmer	EVMLGGA00B14 (103)
R5	7030003320	Resistor	ERJ3GEYJ 101 V (100Ω)
R6	7030003540	Resistor	ERJ3GEYJ 682 V (6.8 kΩ)
R7	7030003440	Resistor	ERJ3GEYJ 102 V (1 kΩ)
R8	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R9	7030003480	Resistor	ERJ3GEYJ 222 V (2.2 kΩ)
R13	7030003560	Resistor	ERJ3GEYJ 103 V (10 kΩ)
R14	7030001010	Resistor	MCR50JZHJ 10Ω (100)
R15	7030001190	Resistor	MCR50JZHJ 330Ω (331)
R16	7030001130	Resistor	MCR50JZHJ 100Ω (101)
R17	7030003560	Resistor	ERJ3GEYJ 103 V (10 kΩ)

**[MAIN UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1150000750	IC	SC1054
IC2	1110001700	IC	TL499ACPS
IC3	1110002020	IC	TA7805S
IC4	1110000490	IC	AN6541
IC5	1130000830	IC	μPD4094BG-T1
IC6	1130004670	IC	BU4021BF-T1
IC7	1130000830	IC	μPD4094BG-T1
IC8	1110000890	IC	μPC1241H
Q1	1530002240	Transistor	2SC3775-3-TA
Q2	1520000380	Transistor	2SB1143 S
Q3	1590000420	Transistor	RN1404 (TE85R)
Q4	1530000160	Transistor	2SC2712-Y (TE85RTEM)
Q5	1530002050	Transistor	2SC3661-TA
Q6	1510000580	Transistor	2SA1362-GR (TE85R)
Q7	1530000160	Transistor	2SC2712-Y (TE85RTEM)
Q8	1510000700	Transistor	2SA1736 (TE12R)
Q9	1590001020	Transistor	RN2424 (TE85R)
Q10	1590000420	Transistor	RN1404 (TE85R)
Q11	1590000830	Transistor	FMG2 T149
Q12	1510000700	Transistor	2SA1736 (TE12R)
Q13	1530002050	Transistor	2SC3661-TA
Q15	1590000690	Transistor	IMD6 T108
Q16	1590000690	Transistor	IMD6 T108
Q17	1580000360	FET	3SK177-T2B U73
Q19	1530002240	Transistor	2SC3775-3-TA
Q20	1580000360	FET	3SK177-T2B U73
Q21	1590000690	Transistor	IMD6 T108
Q22	1530002020	Transistor	2SC3770-3-TA
Q23	1590000520	FET	2SJ106-GR (TE85R)

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
R18	7030003520	Resistor ERJ3GEYJ 472 V (4.7 kΩ)
R20	7030003520	Resistor ERJ3GEYJ 472 V (4.7 kΩ)
R21	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R22	7030003560	Resistor ERJ3GEYJ 103 V (10 kΩ)
R23	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R24	7030003320	Resistor ERJ3GEYJ 101 V (100Ω)
R25	7030003520	Resistor ERJ3GEYJ 472 V (4.7 kΩ)
R26	7030003530	Resistor ERJ3GEYJ 562 V (5.6 kΩ)
R27	7030003410	Resistor ERJ3GEYJ 561 V (560Ω)
R28	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R29	7030003530	Resistor ERJ3GEYJ 562 V (5.6 kΩ)
R30	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R31	7030003480	Resistor ERJ3GEYJ 222 V (2.2 kΩ)
R32	7030003480	Resistor ERJ3GEYJ 222 V (2.2 kΩ)
R35	7030003560	Resistor ERJ3GEYJ 103 V (10 kΩ)
R36	7030001210	Resistor MCR50JZHJ 470Ω (471)
R37	7030003570	Resistor ERJ3GEYJ 123 V (12 kΩ)
R38	4610001020	Trimmer EVMLGGA00B24 (203)
R39	7030003470	Resistor ERJ3GEYJ 182 V (1.8 kΩ)
R40	7030003510	Resistor ERJ3GEYJ 392 V (3.9 kΩ)
R41	7030003500	Resistor ERJ3GEYJ 332 V (3.3 kΩ)
R42	7030003550	Resistor ERJ3GEYJ 822 V (8.2 kΩ)
R43	7030003470	Resistor ERJ3GEYJ 182 V (1.8 kΩ)
R44	7030003450	Resistor ERJ3GEYJ 122 V (1.2 kΩ)
R45	7010004750	Resistor R50XJ 220Ω
R46	7030003650	Resistor ERJ3GEYJ 563 V (56 kΩ)
R47	7030003610	Resistor ERJ3GEYJ 273 V (27 kΩ)
R48	7030003610	Resistor ERJ3GEYJ 273 V (27 kΩ)
R50	7030003740	Resistor ERJ3GEYJ 334 V (330 kΩ)
R51	7030003570	Resistor ERJ3GEYJ 123 V (12 kΩ)
R53	7030003320	Resistor ERJ3GEYJ 101 V (100Ω)
R55	7030003320	Resistor ERJ3GEYJ 101 V (100Ω)
R56	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R57	7030003360	Resistor ERJ3GEYJ 221 V (220Ω)
R58	7030003560	Resistor ERJ3GEYJ 103 V (10 kΩ)
R59	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R60	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R61	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R62	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R63	7030003310	Resistor ERJ3GEYJ 820 V (82Ω)
R64	7030003320	Resistor ERJ3GEYJ 101 V (100Ω)
R65	7030003580	Resistor ERJ3GEYJ 153 V (15 kΩ)
R66	7030003520	Resistor ERJ3GEYJ 472 V (4.7 kΩ)
R67	7030003310	Resistor ERJ3GEYJ 820 V (82Ω)
R68	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R69	7030003620	Resistor ERJ3GEYJ 333 V (33 kΩ)
R70	7030003480	Resistor ERJ3GEYJ 222 V (2.2 kΩ)
R71	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R72	7030003560	Resistor ERJ3GEYJ 103 V (10 kΩ)
R73	7030003560	Resistor ERJ3GEYJ 103 V (10 kΩ)
R74	7030003610	Resistor ERJ3GEYJ 273 V (27 kΩ)
R75	7030000080	Resistor MCR10EZHZ 3.3Ω (3R3)
R76	7030003440	Resistor ERJ3GEYJ 102 V (1 kΩ)
R77	7030004010	Resistor ERJ3GEYJ 2R2 V (2.2Ω)
R78	7030003480	Resistor ERJ3GEYJ 222 V (2.2 kΩ)
R79	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R80	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R81	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R82	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R83	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R84	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R85	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R86	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R88	7030003700	Resistor ERJ3GEYJ 154 V (150 kΩ)
R89	7030003620	Resistor ERJ3GEYJ 333 V (33 kΩ)
R94	7030003320	Resistor ERJ3GEYJ 101 V (100Ω)
R95	7030003740	Resistor ERJ3GEYJ 334 V (330 kΩ)
R96	7030003480	Resistor ERJ3GEYJ 222 V (2.2 kΩ)
R97	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
R98	7030003350	Resistor ERJ3GEYJ 181 V (180Ω)
R99	7030003350	Resistor ERJ3GEYJ 181 V (180Ω)
R101	7030003320	Resistor ERJ3GEYJ 101 V (100Ω)
R102	7030003540	Resistor ERJ3GEYJ 682 V (6.8 kΩ)
R103	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
R104	7030003520	Resistor ERJ3GEYJ 472 V (4.7 kΩ)
R105	7030003560	Resistor ERJ3GEYJ 103 V (10 kΩ)
R106	7030003570	Resistor ERJ3GEYJ 123 V (12 kΩ)
R107	7030003630	Resistor ERJ3GEYJ 393 V (39 kΩ) (EUR), (AUS)
	7030003570	Resistor ERJ3GEYJ 123 V (12 kΩ) (USA)
R108	7030003640	Resistor ERJ3GEYJ 473 V (47 kΩ)
R109	7030003640	Resistor ERJ3GEYJ 473 V (47 kΩ)
R110	7030003520	Resistor ERJ3GEYJ 472 V (4.7 kΩ)
R111	7030003370	Resistor ERJ3GEYJ 271 V (270Ω)
R112	7030003230	Resistor ERJ3GEYJ 180 V (18Ω)
R113	7030003370	Resistor ERJ3GEYJ 271 V (270Ω)
R114	7030003520	Resistor ERJ3GEYJ 472 V (4.7 kΩ)
R115	7030003680	Resistor ERJ3GEYJ 104 V (100 kΩ)
C1	4030008680	Ceramic C2012 JF 1C 105Z-T-A
C2	4030006850	Ceramic C1608 JB 1H 471K-T-A
C3	4030006850	Ceramic C1608 JB 1H 471K-T-A
C4	4030006850	Ceramic C1608 JB 1H 471K-T-A
C6	4030006850	Ceramic C1608 JB 1H 471K-T-A
C7	4610000300	Trimmer ECRGA015E30
C8	4030007030	Ceramic C1608 CH 1H 150J-T-A
C9	4030007060	Ceramic C1608 CH 1E 270J-T-A
C10	4030006900	Ceramic C1608 JB 1E 103K-T-A
C11	4030006550	Ceramic C1608 SL 1H 040C-T-A
C12	4030006860	Ceramic C1608 JB 1H 102K-T-A
C13	4030006560	Ceramic C1608 SL 1H 050C-T-A
C14	4030006860	Ceramic C1608 JB 1H 102K-T-A
C15	4030006860	Ceramic C1608 JB 1H 102K-T-A
C16	4030006860	Ceramic C1608 JB 1H 102K-T-A
C17	4030006860	Ceramic C1608 JB 1H 102K-T-A
C18	4030006860	Ceramic C1608 JB 1H 102K-T-A
C19	4550001030	Tantalum TESVD 1E 106M-12L
C20	4030006860	Ceramic C1608 JB 1H 102K-T-A
C21	4550003200	Tantalum TEMSVC 1D 106M-12 L
C22	4030006860	Ceramic C1608 JB 1H 102K-T-A
C23	4030006860	Ceramic C1608 JB 1H 102K-T-A
C24	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C25	4030006860	Ceramic C1608 JB 1H 102K-T-A
C26	4010004120	Ceramic DD07 B 102K 500V
C27	4030003500	Ceramic UC232H 0060D
C28	4030008710	Ceramic UC232H 0120F
C29	4030006860	Ceramic C1608 JB 1H 102K-T-A
C30	4030006860	Ceramic C1608 JB 1H 102K-T-A
C31	4010003820	Ceramic DD06 SL 050C 500V
C32	4030006860	Ceramic C1608 JB 1H 102K-T-A
C33	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C34	4510002970	Electrolytic 50 SS 4R7 μF
C35	4550000260	Tantalum DN 1V 100M
C36	4550000320	Tantalum DN 1V 0R1M
C37	4510002730	Electrolytic 10 SS 100 μF
C38	4510002730	Electrolytic 10 SS 100 μF
C39	4030006860	Ceramic C1608 JB 1H 102K-T-A
C40	4510002640	Electrolytic 25 SS 47 μF
C41	4510002640	Electrolytic 25 SS 47 μF
C42	4030006860	Ceramic C1608 JB 1H 102K-T-A
C43	4510002640	Electrolytic 25 SS 47 μF
C44	4030006900	Ceramic C1608 JB 1E 103K-T-A
C45	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C46	4030008680	Ceramic C2012 JF 1C 105Z-T-A
C47	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C48	4030006860	Ceramic C1608 JB 1H 102K-T-A
C49	4510002640	Electrolytic 25 SS 47 μF



**[MAIN UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION
C50	4510002640	Electrolytic 25 SS 47 $\mu$ F
C51	4030006900	Ceramic C1608 JB 1E 103K-T-A
C53	4030006860	Ceramic C1608 JB 1H 102K-T-A
C54	4030006900	Ceramic C1608 JB 1E 103K-T-A
C55	4510002820	Electrolytic 16 SS 1000 $\mu$ F
C56	4030006850	Ceramic C1608 JB 1H 471K-T-A
C57	4030006900	Ceramic C1608 JB 1E 103K-T-A
C58	4550000290	Tantalum TESVC 1A 106M-12L
C59	4030006850	Ceramic C1608 JB 1H 471K-T-A
C60	4030006900	Ceramic C1608 JB 1E 103K-T-A
C61	4030006860	Ceramic C1608 JB 1H 102K-T-A
C62	4030006900	Ceramic C1608 JB 1E 103K-T-A
C63	4030006710	Ceramic C1608 SL 1H 470J-T-A
C64	4030006620	Ceramic C1608 SL 1H 120J-T-A
C65	4030006760	Ceramic C1608 SL 1H 121J-T-A
C66	4030006900	Ceramic C1608 JB 1E 103K-T-A
C67	4030006570	Ceramic C1608 SL 1H 060D-T-A
C68	4030006710	Ceramic C1608 SL 1H 470J-T-A
C70	4030006750	Ceramic C1608 SL 1H 101J-T-A
C71	4030006850	Ceramic C1608 JB 1H 471K-T-A
C72	4030006660	Ceramic C1608 SL 1H 220J-T-A
C73	4030006520	Ceramic C1608 SL 1H 010C-T-A
C74	4030006860	Ceramic C1608 JB 1H 102K-T-A
C75	4030006860	Ceramic C1608 JB 1H 102K-T-A
C76	4030006860	Ceramic C1608 JB 1H 102K-T-A
C77	4030006850	Ceramic C1608 JB 1H 471K-T-A
C78	4030006670	Ceramic C1608 SL 1H 270J-T-A
C80	4610000920	Trimmer ECRGA010A30
C81	4030006860	Ceramic C1608 JB 1H 102K-T-A
C82	4030006860	Ceramic C1608 JB 1H 102K-T-A
C83	4030006860	Ceramic C1608 JB 1H 102K-T-A
C84	4610000920	Trimmer ECRGA010A30
C85	4030006540	Ceramic C1608 SL 1H 030C-T-A
C86	4030006640	Ceramic C1608 SL 1H 180J-T-A
C87	4030006690	Ceramic C1608 SL 1H 330J-T-A
C88	4030006640	Ceramic C1608 SL 1H 180J-T-A
C89	4030006580	Ceramic C1608 SL 1H 070D-T-A
C90	4030006620	Ceramic C1608 SL 1H 120J-T-A
C91	4030006860	Ceramic C1608 JB 1H 102K-T-A
C92	4010003820	Ceramic DD06 SL 050C 500V
C93	4030006860	Ceramic C1608 JB 1H 102K-T-A
C94	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C95	4510001460	Electrolytic 50 MS5 R47 $\mu$ F
C96	4510001470	Electrolytic 50 MS5 1 $\mu$ F
C97	4030006860	Ceramic C1608 JB 1H 102K-T-A
C98	4550000320	Tantalum DN 1V 0R1M
C99	4030006860	Ceramic C1608 JB 1H 102K-T-A
C100	4510002640	Electrolytic 25 SS 47 $\mu$ F
C101	4510002740	Electrolytic 10 SS 220 $\mu$ F
C102	4030008760	Ceramic C2012 X7R 1C 104K-T-A
C103	4510002640	Electrolytic 25 SS 47 $\mu$ F
C104	4510002760	Electrolytic 10 SS 470 $\mu$ F
C105	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C107	4030006860	Ceramic C1608 JB 1H 102K-T-A
C108	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C109	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C110	4030006860	Ceramic C1608 JB 1H 102K-T-A
C111	4030006860	Ceramic C1608 JB 1H 102K-T-A
C112	4030006860	Ceramic C1608 JB 1H 102K-T-A
C113	4030006860	Ceramic C1608 JB 1H 102K-T-A
C114	4030006860	Ceramic C1608 JB 1H 102K-T-A
C115	4030006710	Ceramic C1608 SL 1H 470J-T-A
C116	4030006710	Ceramic C1608 SL 1H 470J-T-A
C117	4030006860	Ceramic C1608 JB 1H 102K-T-A
C118	4030006850	Ceramic C1608 JB 1H 471K-T-A
C119	4030006710	Ceramic C1608 SL 1H 470J-T-A
C121	4030006710	Ceramic C1608 SL 1H 470J-T-A
C122	4030006710	Ceramic C1608 SL 1H 470J-T-A
C123	4510001820	Electrolytic 10 MS5 10 $\mu$ F (D. 3.0)

**[MAIN UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION
C124	4030006710	Ceramic C1608 SL 1H 470J-T-A
C125	4030006710	Ceramic C1608 SL 1H 470J-T-A
C126	4030008680	Ceramic C2012 JF 1C 105Z-T-A
C127	4030006710	Ceramic C1608 SL 1H 470J-T-A
C128	4030006710	Ceramic C1608 SL 1H 470J-T-A
C129	4030006710	Ceramic C1608 SL 1H 470J-T-A
C130	4030006710	Ceramic C1608 SL 1H 470J-T-A
C131	4030006710	Ceramic C1608 SL 1H 470J-T-A
C132	4030006710	Ceramic C1608 SL 1H 470J-T-A
C133	4030006710	Ceramic C1608 SL 1H 470J-T-A
C134	4030006710	Ceramic C1608 SL 1H 470J-T-A
C135	4030006710	Ceramic C1608 SL 1H 470J-T-A
C136	4030006710	Ceramic C1608 SL 1H 470J-T-A
C137	4030006710	Ceramic C1608 SL 1H 470J-T-A
C138	4030006710	Ceramic C1608 SL 1H 470J-T-A
C139	4030006710	Ceramic C1608 SL 1H 470J-T-A
C140	4030006710	Ceramic C1608 SL 1H 470J-T-A
C141	4030006860	Ceramic C1608 JB 1H 102K-T-A
C142	4030006860	Ceramic C1608 JB 1H 102K-T-A
C143	4030006860	Ceramic C1608 JB 1H 102K-T-A
C144	4030006860	Ceramic C1608 JB 1H 102K-T-A
C145	4030006860	Ceramic C1608 JB 1H 102K-T-A
C146	4030008630	Ceramic C1608 JF 1C 104Z-T-A
C147	4030004760	Ceramic C2012 JF 1E 104Z-T-A
C148	4030006860	Ceramic C1608 JB 1H 102K-T-A
C149	4030006850	Ceramic C1608 JB 1H 471K-T-A
C150	4030006860	Ceramic C1608 JB 1H 102K-T-A
C152	4030006860	Ceramic C1608 JB 1H 102K-T-A
C154	4030006860	Ceramic C1608 JB 1H 102K-T-A
C155	4030006710	Ceramic C1608 SL 1H 470J-T-A
C156	4030006710	Ceramic C1608 SL 1H 470J-T-A
C157	4030006860	Ceramic C1608 JB 1H 102K-T-A
C160	4030006860	Ceramic C1608 JB 1H 102K-T-A
C161	4030006900	Ceramic C1608 JB 1E 103K-T-A
C162	4510001460	Electrolytic 50 MS5 R47 $\mu$ F
C163	4030006860	Ceramic C1608 JB 1H 102K-T-A
C164	4010003810	Ceramic DD06 SL 040C 500V
C165	4030006860	Ceramic C1608 JB 1H 102K-T-A
C166	4030006860	Ceramic C1608 JB 1H 102K-T-A
C167	4030006710	Ceramic C1608 SL 1H 470J-T-A
C168	4030006860	Ceramic C1608 JB 1H 102K-T-A
C169	4030006860	Ceramic C1608 JB 1H 102K-T-A
C170	4030006850	Ceramic C1608 JB 1H 471K-T-A
C171	4030006900	Ceramic C1608 JB 1E 103K-T-A
C172	4030006860	Ceramic C1608 JB 1H 102K-T-A
C173	4030006850	Ceramic C1608 JB 1H 471K-T-A
C174	4030006900	Ceramic C1608 JB 1E 103K-T-A
C175	4030006850	Ceramic C1608 JB 1H 471K-T-A
C176	4030006860	Ceramic C1608 JB 1H 102K-T-A
C177	4030006850	Ceramic C1608 JB 1H 471K-T-A
C178	4030006850	Ceramic C1608 JB 1H 471K-T-A
C179	4030006850	Ceramic C1608 JB 1H 471K-T-A
C180	4030006860	Ceramic C1608 JB 1H 102K-T-A
C181	4030006860	Ceramic C1608 JB 1H 102K-T-A
C182	4030006860	Ceramic C1608 JB 1H 102K-T-A
C183	4030006860	Ceramic C1608 JB 1H 102K-T-A
EP1	0910025694	P.C. Board B 2372D (MAIN)
EP14	6910000970	Lead Frame DL 2OP 2.6-3-1.2H

**[PLL-A UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION
IC1	1120001550	IC M54959FP
Q1	1530000160	Transistor 2SC2712-Y (TE85RTEM)



**[PLL-A UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION	
Q2	1560000360	FET	2SK209-Y (TE85R)
D1	1790000490	Diode	HSM88AS-TR
L1	6110001520	Coil	LA-232
L2	6180001410	Coil	LAL 02KR 100K
R1	7030000480	Resistor	MCR10EZHZ 6.8 kΩ (682)
R2	7030000410	Resistor	MCR10EZHZ 1.8 kΩ (182)
R3	7030000350	Resistor	MCR10EZHZ 560Ω (561)
R4	7030000380	Resistor	MCR10EZHZ 1 kΩ (102)
R5	7030000260	Resistor	MCR10EZHZ 100Ω (101)
R6	7030000320	Resistor	MCR10EZHZ 330Ω (331)
R7	7030000580	Resistor	MCR10EZHZ 47 kΩ (473)
R8	7030000400	Resistor	MCR10EZHZ 1.5 kΩ (152)
C1	4550000550	Tantalum	TESVA 1V 224M1-8L
C2	4550000410	Tantalum	DN 1V 4R7M
C3	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C4	4030004440	Ceramic	C2012 SL 1H 070D-T-A
C5	4030004440	Ceramic	C2012 SL 1H 070D-T-A
C6	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C7	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C8	4550003030	Tantalum	TEMSVA 0J 475M-8L
C9	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C10	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C11	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C12	4030004720	Ceramic	C2012 JB 1H 102K-T-A
EP1	0910026161	P.C. Board	B 2641A (PLL-A)

**[VCO UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION	
Q1	1560000130	FET	2SK125
Q2	1530002030	Transistor	2SC3772-3-TA
D1	1720000220	Varicap	1SV166-T2B
D2	1720000220	Varicap	1SV166-T2B
L1	6180002420	Coil	LAL 02KR R39K
L2	6180002420	Coil	LAL 02KR R39K
L3	6180001380	Coil	LAL 02KR 1R0K
L4	6180002500	Coil	LAL 02KR R27K
L5	6110001530	Coil	LA-233
R1	7030000140	Resistor	MCR10EZHZ 10Ω (100)
R2	7030000140	Resistor	MCR10EZHZ 10Ω (100)
R3	7030000260	Resistor	MCR10EZHZ 100Ω (101)
R4	7030000480	Resistor	MCR10EZHZ 6.8 kΩ (682)
R5	7030000260	Resistor	MCR10EZHZ 100Ω (101)
R6	7030000270	Resistor	MCR10EZHZ 120Ω (121)
R7	7030000520	Resistor	MCR10EZHZ 15 kΩ (153)
R8	7030000460	Resistor	MCR10EZHZ 4.7 kΩ (472)
R9	7030000160	Resistor	MCR10EZHZ 15Ω (150)
R10	7030000160	Resistor	MCR10EZHZ 15Ω (150)
R11	7030000160	Resistor	MCR10EZHZ 15Ω (150)
C1	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C2	4510001840	Electrolytic	10 MS5 47 μF

**[VCO UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION	
C3	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C4	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C5	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C6	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C7	4510001840	Electrolytic	10 MS5 47 μF
C8	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C9	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C10	4030004580	Ceramic	C2012 SL 1H 560J-T-A
C11	4030004440	Ceramic	C2012 SL 1H 070D-T-A
C12	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C13	4030004830	Ceramic	C2012 CH 1H 060D-T-A
C14	4030004370	Ceramic	C2012 SL 1H 0R5C-T-A
C15	4030004420	Ceramic	C2012 SL 1H 050C-T-A
C16	4030004710	Ceramic	C2012 JB 1H 471K-T-A
EP1	0910026301	P.C. Board	B 2647A (VCO)

**[APC UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1110001240	IC	μPC358G2-T1
Q1	1530000160	Transistor	2SC2712-Y (TE85RTEM)
R1	7030000580	Resistor	MCR10EZHZ 47 kΩ (473)
R2	7030000580	Resistor	MCR10EZHZ 47 kΩ (473)
R3	7030000500	Resistor	MCR10EZHZ 10 kΩ (103)
R4	7030000580	Resistor	MCR10EZHZ 47 kΩ (473)
R5	7030000500	Resistor	MCR10EZHZ 10 kΩ (103)
R6	7030000690	Resistor	MCR10EZHZ 390 kΩ (394)
R7	7030000510	Resistor	MCR10EZHZ 12 kΩ (123)
R8	7030000460	Resistor	MCR10EZHZ 4.7 kΩ (472)
R9	7030000460	Resistor	MCR10EZHZ 4.7 kΩ (472)
R10	7030000540	Resistor	MCR10EZHZ 22 kΩ (223)
R11	7030000730	Resistor	MCR10EZHZ 820 kΩ (824)
R13	7030000260	Resistor	MCR10EZHZ 100Ω (101)
C1	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C2	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C3	4510001820	Electrolytic	10 MS5 10 μF (D 3.0)
C4	4510001820	Electrolytic	10 MS5 10 μF (D 3.0)
C5	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C6	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C7	4030004710	Ceramic	C2012 JB 1H 471K-T-A
EP1	0910027560	P.C. Board	B 2404 (APC)
EP2	6910001400	Lead Frame	VD2.54-0.7-7

**[MIC-AMP UNIT]**

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1110000960	IC	NJM4558M (T1)
Q1	1530002690	Transistor	2SC4116-GR (TE85R)
R1	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R2	7030003600	Resistor	ERJ3GEYJ 223 V (22 kΩ)
R3	7030003280	Resistor	ERJ3GEYJ 470 V (47Ω)
R4	7030003420	Resistor	ERJ3GEYJ 681 V (680Ω)
R5	7030003390	Resistor	ERJ3GEYJ 391 V (390Ω)
R6	7030003740	Resistor	ERJ3GEYJ 334 V (330 kΩ)

[MIC-AMP UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R7	7030003750	Resistor	ERJ3GEYJ 394 V (390 kΩ)
R8	7030003790	Resistor	ERJ3GEYJ 824 V (820 kΩ)
R9	7030003710	Resistor	ERJ3GEYJ 184 V (180 kΩ)
R10	7030003580	Resistor	ERJ3GEYJ 153 V (15 kΩ)
R11	7030003720	Resistor	ERJ3GEYJ 224 V (220 kΩ)
R12	7030003670	Resistor	ERJ3GEYJ 823 V (82 kΩ)
R13	7030003670	Resistor	ERJ3GEYJ 823 V (82 kΩ)
R14	7030003670	Resistor	ERJ3GEYJ 823 V (82 kΩ)
R15	7030003320	Resistor	ERJ3GEYJ 101 V (100Ω)
C1	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C2	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C3	4030008660	Ceramic	C2012 JB 1H 333K-T-A
C4	4550000460	Tantalum	TESVA 1C 105M1-8L
C5	4030007020	Ceramic	C1608 CH 1H 120J-T-A
C6	4030004760	Ceramic	C2012 JF 1E 104Z-T-A
C7	4030008690	Ceramic	C2012 SL 1H 821J-T-A
C8	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C9	4030006740	Ceramic	C1608 SL 1H 820J-T-A
C10	4030008650	Ceramic	C1608 JB 1H 332K-T-A
C11	4030006750	Ceramic	C1608 SL 1H 101J-T-A
C12	4550003080	Tantalum	TEMSVA 1A 335M-8L
EP1	0910027532	P.C. Board	B 2377B (MIC-AMP)
EP2	6910003330	Lead Frame	PD2.0-0.9-8

[YGR UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
Q1	1530002240	Transistor	2SC3775-3-TA
Q2	1590000390	Transistor	MRF559
D1	1750000050	Diode	1SS193(TE85R)
L1	6200000770	Coil	LQN 2A 68NM
L2	6200000720	Coil	LQN 2A 10NM
L3	6200000720	Coil	LQN 2A 10NM
L4	6200000190	Coil	NL 322522T-022M
R1	7030003320	Resistor	ERJ3GEYJ 101 V (100Ω)
R2	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R3	7030003450	Resistor	ERJ3GEYJ 122 V (1.2 kΩ)
R4	7030003440	Resistor	ERJ3GEYJ 102 V (1 kΩ)
R5	7030003340	Resistor	ERJ3GEYJ 151 V (150Ω)
R6	7030003440	Resistor	ERJ3GEYJ 102 V (1 kΩ)
C1	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C2	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C3	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C4	4030006610	Ceramic	C1608 SL 1H 100D-T-A
C5	4030006580	Ceramic	C1608 SL 1H 070D-T-A
C6	4030006570	Ceramic	C1608 SL 1H 060D-T-A
C7	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C8	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C9	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C10	4030006660	Ceramic	C1608 SL 1H 220J-T-A
C11	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C12	4030006860	Ceramic	C1608 JB 1H 102K-T-A

[YGR UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
EP1	0910026620	P.C. Board	B 2654 (YGR)
EP2	6910003330	Lead Frame	PD2.0-0.9-8

[IF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1110002200	IC	MC3372MR
Q1	1530002280	Transistor	2SC4081 T107 S
Q2	1530002280	Transistor	2SC4081 T107 S
Q3	1590000830	Transistor	FMG2 T149
Q4	1530002280	Transistor	2SC4081 T107 S
Q5	1590000520	FET	2SJ106-GR (TE85R)
Q6	1530002280	Transistor	2SC4081 T107 S
Q7	1530002280	Transistor	2SC4081 T107 S
D1	1730000490	Zener	RD6.8M-T2B2
D2	1790000490	Diode	HSM88AS-TR
X1	6050005010	Crystal	CR-214
X2	6070000080	Discriminator	CDBM455C16
Fl1	2020000550	Ceramic Filter	CFUM455E
R1	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R2	4610001360	Trimmer	EVML1GA00B15 100KB
R4	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R5	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R6	7030003400	Resistor	ERJ3GEYJ 471 V (470Ω)
R7	7030003500	Resistor	ERJ3GEYJ 332 V (3.3 kΩ)
R8	7030003480	Resistor	ERJ3GEYJ 222 V (2.2 kΩ)
R10	7030003470	Resistor	ERJ3GEYJ 182 V (1.8 kΩ)
R12	7030003730	Resistor	ERJ3GEYJ 274 V (270 kΩ)
R13	7030003730	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R14	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R15	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R16	7030003700	Resistor	ERJ3GEYJ 154 V (150 kΩ)
R17	7030000260	Resistor	MCR10EZJH 100Ω (101)
R19	7030003840	Resistor	ERJ3GEYJ 225 V (2.2 MΩ)
R20	7030003490	Resistor	ERJ3GEYJ 272 V (2.7 kΩ)
R21	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R23	7030003760	Resistor	ERJ3GEYJ 474 V (470 kΩ)
R24	7030003630	Resistor	ERJ3GEYJ 393 V (39 kΩ)
R25	7030003620	Resistor	ERJ3GEYJ 333 V (33 kΩ)
R26	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R27	7030003530	Resistor	ERJ3GEYJ 562 V (5.6 kΩ)
R28	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R29	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R30	7030003680	Resistor	ERJ3GEYJ 104 V (100 kΩ)
R31	7030003560	Resistor	ERJ3GEYJ 103 V (10 kΩ)
R32	7030003600	Resistor	ERJ3GEYJ 223 V (22 kΩ)
R33	7030003630	Resistor	ERJ3GEYJ 393 V (39 kΩ)
R34	7030003760	Resistor	ERJ3GEYJ 474 V (470 kΩ)
R36	7030003380	Resistor	ERJ3GEYJ 331 V (330Ω)
R37	7030003600	Resistor	ERJ3GEYJ 223 V (22 kΩ)
R38	7030003480	Resistor	ERJ3GEYJ 222 V (2.2 kΩ)
R39	7030003760	Resistor	ERJ3GEYJ 474 V (470 kΩ)
R40	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R42	7030003480	Resistor	ERJ3GEYJ 222 V (2.2 kΩ)
R43	7030003320	Resistor	ERJ3GEYJ 101 V (100Ω)
R44	7030003460	Resistor	ERJ3GEYJ 152 V (1.5 kΩ)

[IF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C1	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C2	4510001100	Electrolytic	16 MS7 10 µF
C3	4030006720	Ceramic	C1608 SL 1H 560J-T-A
C4	4030006640	Ceramic	C1608 SL 1H 180J-T-A
C5	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C6	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C7	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C8	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C9	4030006740	Ceramic	C1608 SL 1H 820J-T-A
C10	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C11	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C12	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C13	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C14	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C15	4030006690	Ceramic	C1608 SL 1H 330J-T-A
C16	4030006900	Ceramic	C1608 JB 1E 103K-T-A
C17	4510001150	Electrolytic	50 MS7 R47 µF
C18	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C19	4510001160	Electrolytic	50 MS7 1 µF
C20	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C21	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C22	4030005110	Ceramic	C2012 JB 1E 473K-T-A
C23	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C24	4030006900	Ceramic	C1608 JB 1E 103K-T-A
C25	4030006900	Ceramic	C1608 JB 1E 103K-T-A
C26	4030006470	Ceramic	C2012 JB 1H 153K-T-A
C27	4030008660	Ceramic	C2012 JB 1H 333K-T-A
C28	4030008660	Ceramic	C2012 JB 1H 333K-T-A
C29	4030008670	Ceramic	C2012 JB 1H 562K-T-A
C30	4030008670	Ceramic	C2012 JB 1H 562K-T-A
C31	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C33	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C34	4030008660	Ceramic	C1608 JB 1H 102K-T-A
EP1	0910027431	P.C. Board	B 2756A (IF)
EP2	6910003330	Lead Frame	PD2.0-0-9-8

[A-BAND UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
Q1	1530002030	Transistor	2SC3772-3-TA
Q2	1530002030	Transistor	2SC3772-3-TA
D1	1790000450	Diode	MA862(TX)
D2	1790000450	Diode	MA862(TX)
D3	1790000450	Diode	MA862(TX)
L1	6200000090	Coil	LQN 2A 18NM
L2	6200000090	Coil	LQN 2A 18NM
L3	6200000090	Coil	LQN 2A 18NM
L4	6200000090	Coil	LQN 2A 18NM
R1	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R2	7030003500	Resistor	ERJ3GEYJ 332 V (3.3 kΩ)
R3	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R4	7030003280	Resistor	ERJ3GEYJ 470 V (47Ω)
R5	7030003650	Resistor	ERJ3GEYJ 563 V (56 kΩ)
R6	7030003400	Resistor	ERJ3GEYJ 471 V (470Ω)
R7	7030003360	Resistor	ERJ3GEYJ 221 V (220Ω)
R8	7030003640	Resistor	ERJ3GEYJ 473 V (47 kΩ)
R9	7030003280	Resistor	ERJ3GEYJ 470 V (47Ω)
R10	7030003280	Resistor	ERJ3GEYJ 470 V (47Ω)
R11	7030003400	Resistor	ERJ3GEYJ 471 V (470Ω)
R12	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)

[A-BAND UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C1	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C2	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C3	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C4	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C5	4030006610	Ceramic	C1608 SL 1H 100D-T-A
C6	4030006580	Ceramic	C1608 SL 1H 070D-T-A
C7	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C8	4030006540	Ceramic	C1608 SL 1H 030C-T-A
C9	4030006570	Ceramic	C1608 SL 1H 060D-T-A
C10	4030006570	Ceramic	C1608 SL 1H 060D-T-A
C11	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C12	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C13	4030006600	Ceramic	C1608 SL 1H 090D-T-A
C14	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C15	4030006590	Ceramic	C1608 SL 1H 080D-T-A
C16	4030006860	Ceramic	C1608 JB 1H 102K-T-A
EP1	0910027542	P.C. Board	B 2378B (A-BAND)
EP2	6910003330	Lead Frame	PD2.0-0-9-8

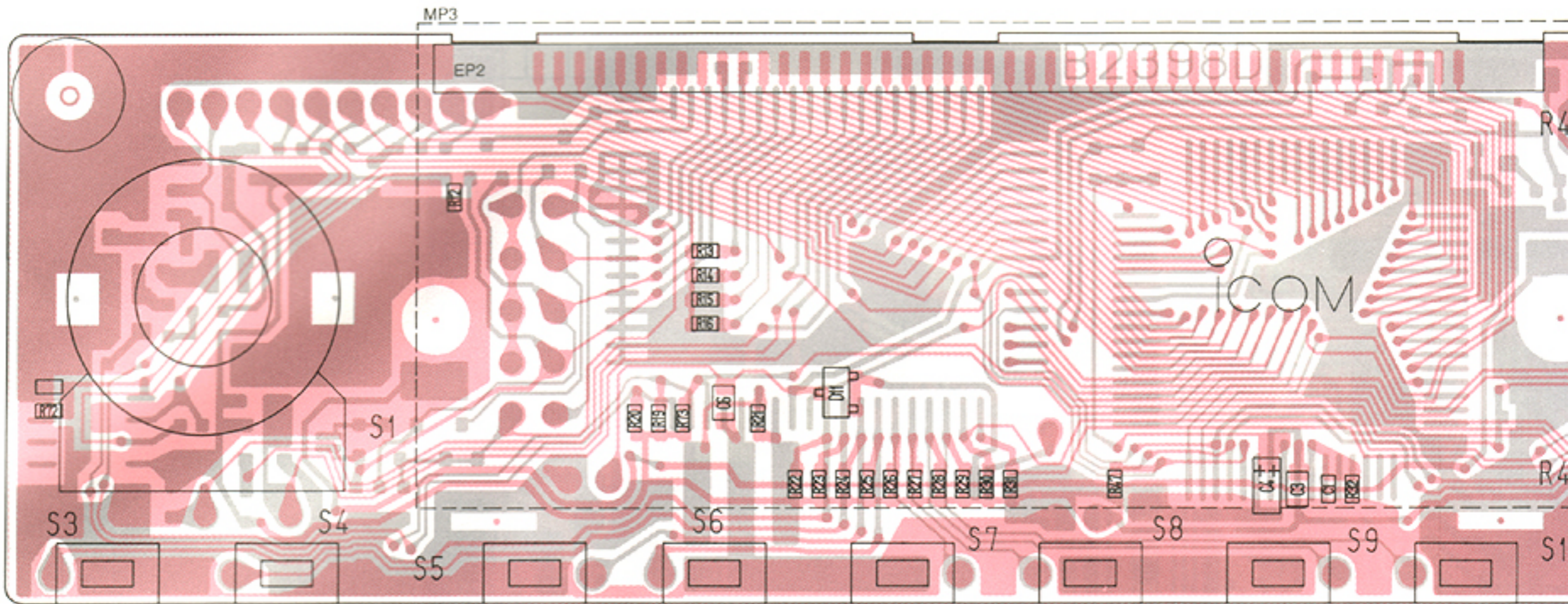
[TONE UNIT] (USA version only)

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1130000950	IC	S7116A
IC2	1130000830	IC	µPD4094BG-T1
Q1	1530002060	Transistor	2SC4081 T107 R
X1	6050006020	Crystal	CR-288
R1	7030003520	Resistor	ERJ3GEYJ 472 V (4.7 kΩ)
R2	7030003620	Resistor	ERJ3GEYJ 333 V (33 kΩ)
R3	7030003800	Resistor	ERJ3GEYJ 105 V (1 MΩ)
R4	7030003460	Resistor	ERJ3GEYJ 152 V (1.5 kΩ)
R5	7310002600	Trimmer	RV-110 (RH03 A3AS4X0AA) 473
C1	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C2	4550002950	Tantalum	TESVA 0J 335M1-8L
C3	4550000530	Tantalum	TESVA 1V 104M1-8L
C4	4030006690	Ceramic	C1608 SL 1H 330J-T-A
C5	4030006690	Ceramic	C1608 SL 1H 330J-T-A
C6	4550000270	Tantalum	TESVA 1E 474M1-8L
EP1	0910020165	P.C. Board	B1942E (TONE)

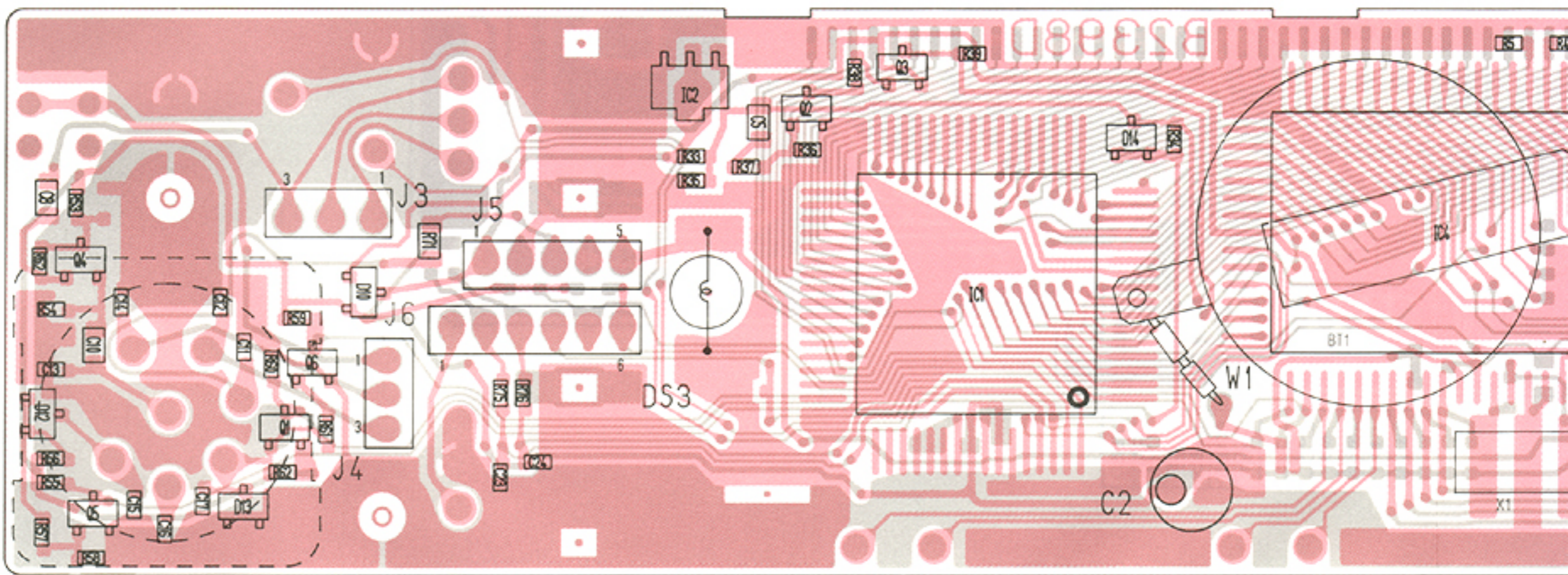


# SECTION 8 BOARD LAYOUTS

## 8-1 LOGIC UNIT

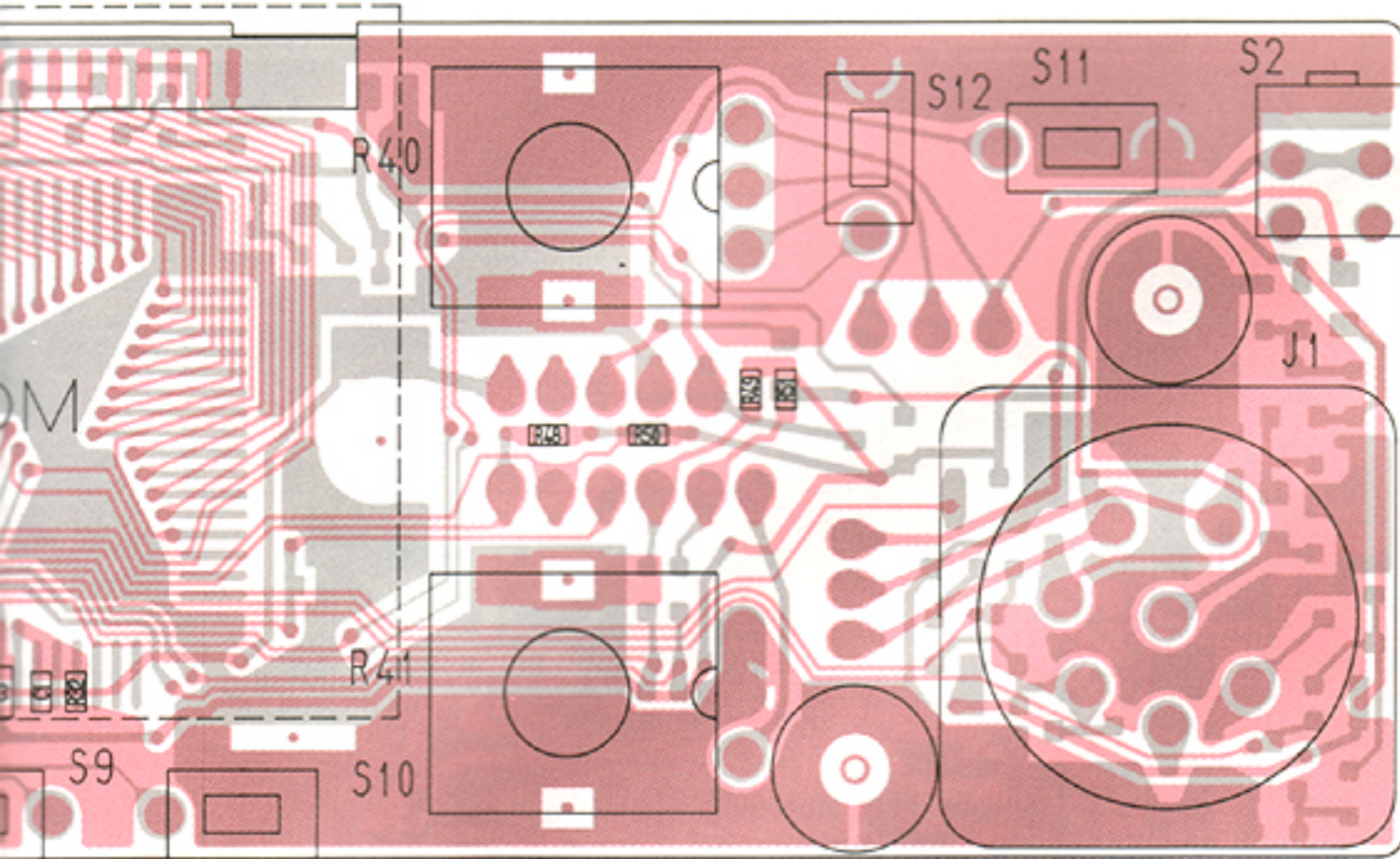


J3 VOL1 VOL2 VOL3      J5 5V E 8V NC LAMP



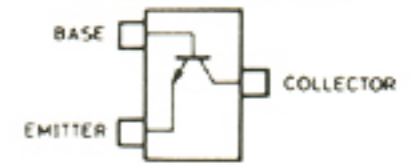
J4 P SW MICE MIC      SCLK CK DATA STROBE SI P/S J6





**2SC2712Y/GR**

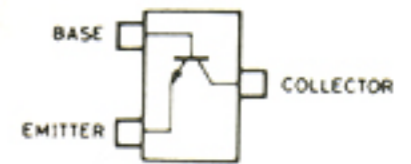
Q2, Q4, Q5, Q6, Q7



Symbol: LY, LG

**2SC1162**

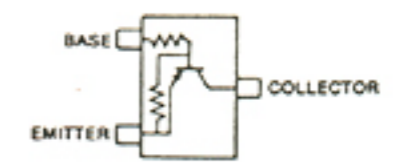
Q3



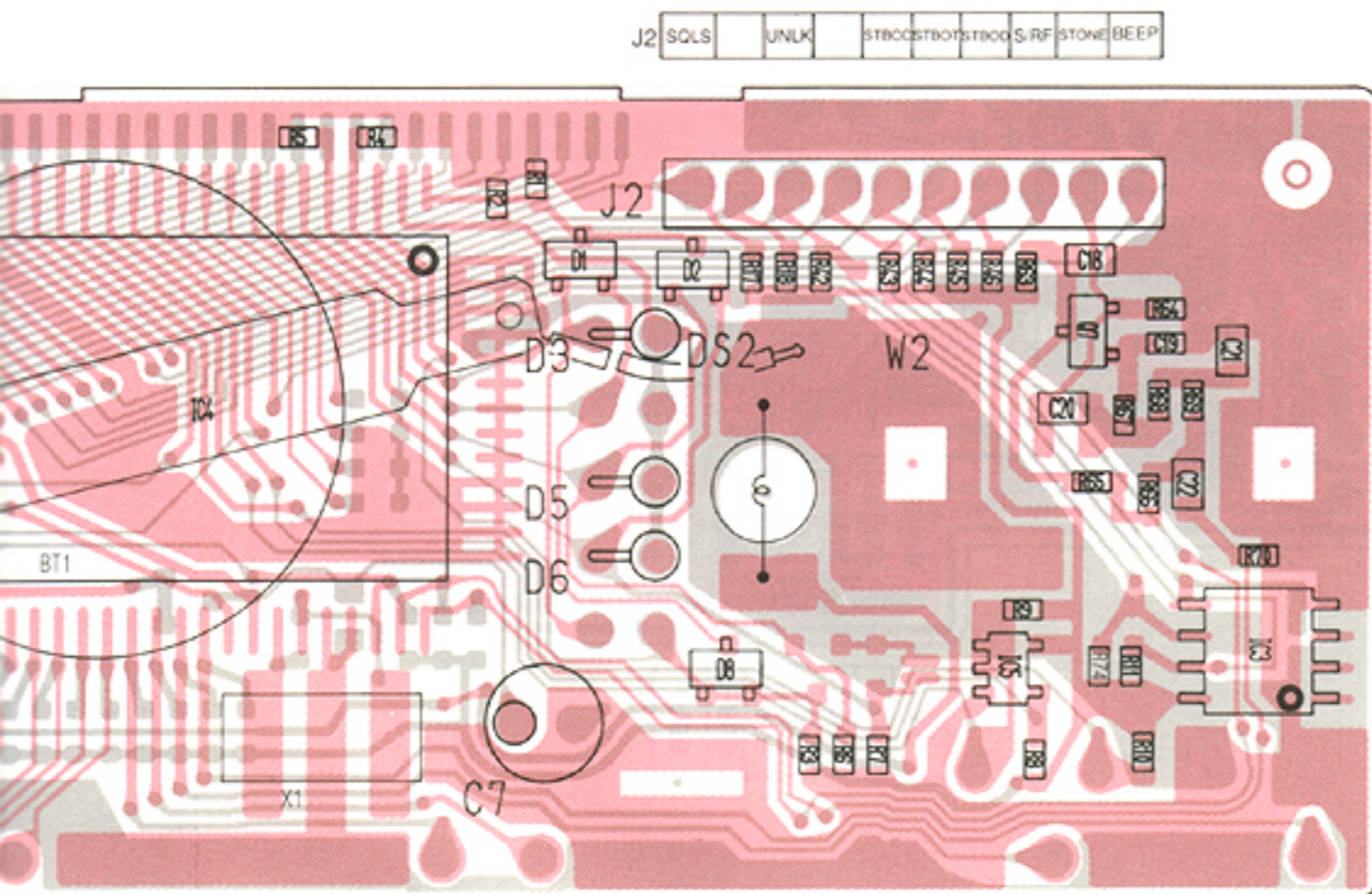
Symbol: CBG

**RN2404**

Q1

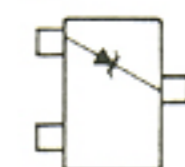


Symbol: YB



**RD9.1MB2**

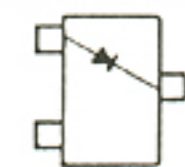
D13



Symbol: 912

**1SS193**

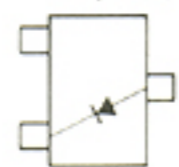
D8, D11, D12, D14



Symbol: F3

**1SS190**

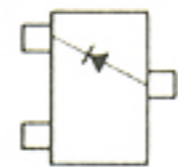
D1 (AUS)



Symbol: E3

**1SS187**

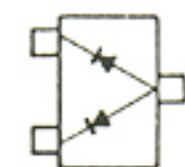
D1 (USA), D2 (EUR)



Symbol: D3

**1SS181**

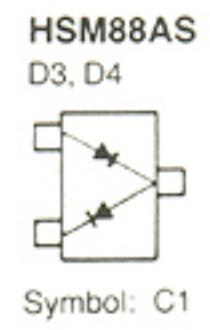
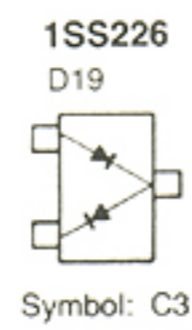
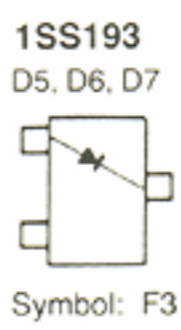
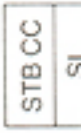
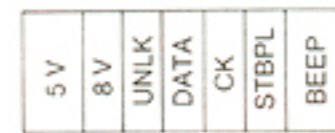
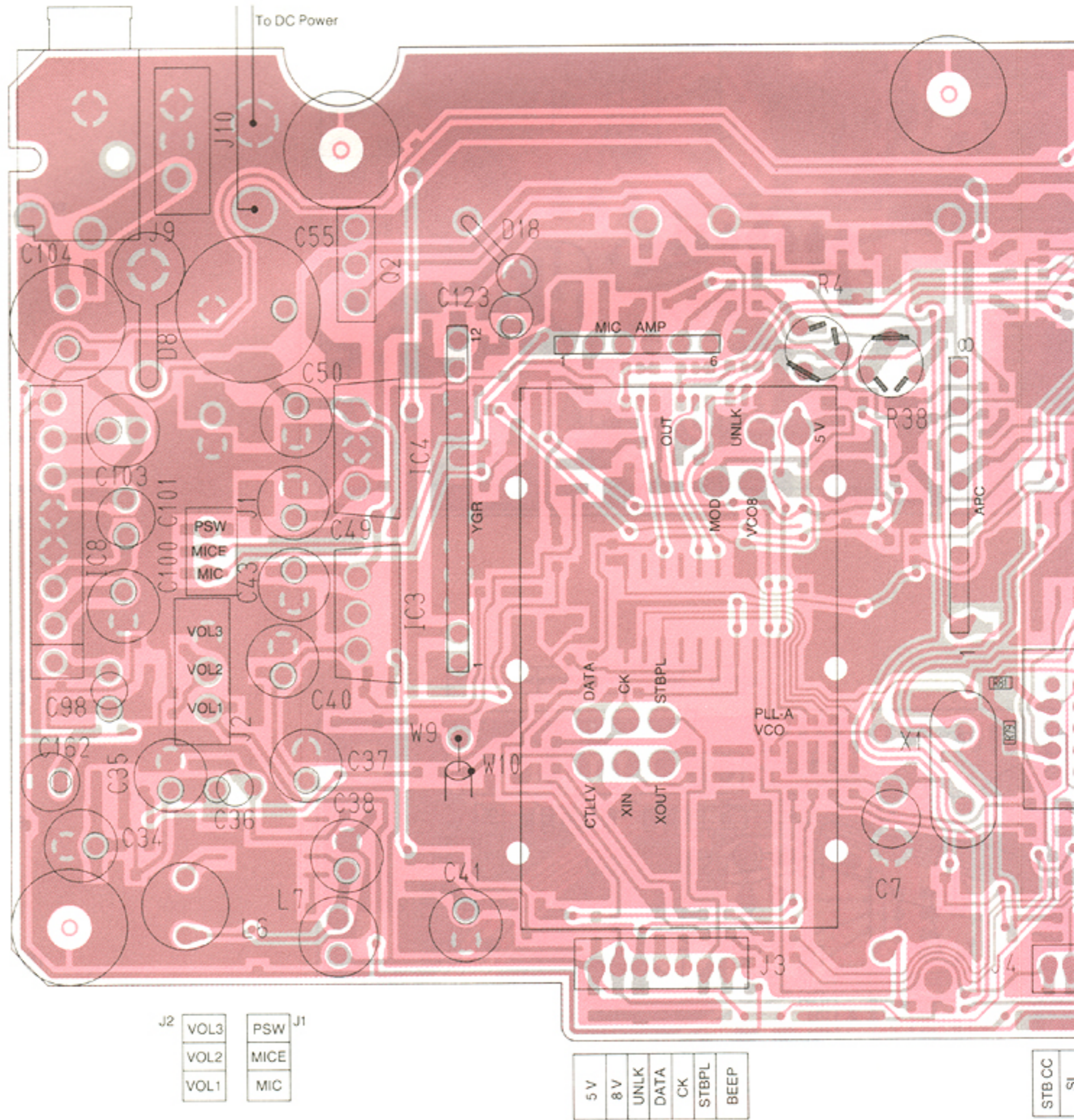
D10



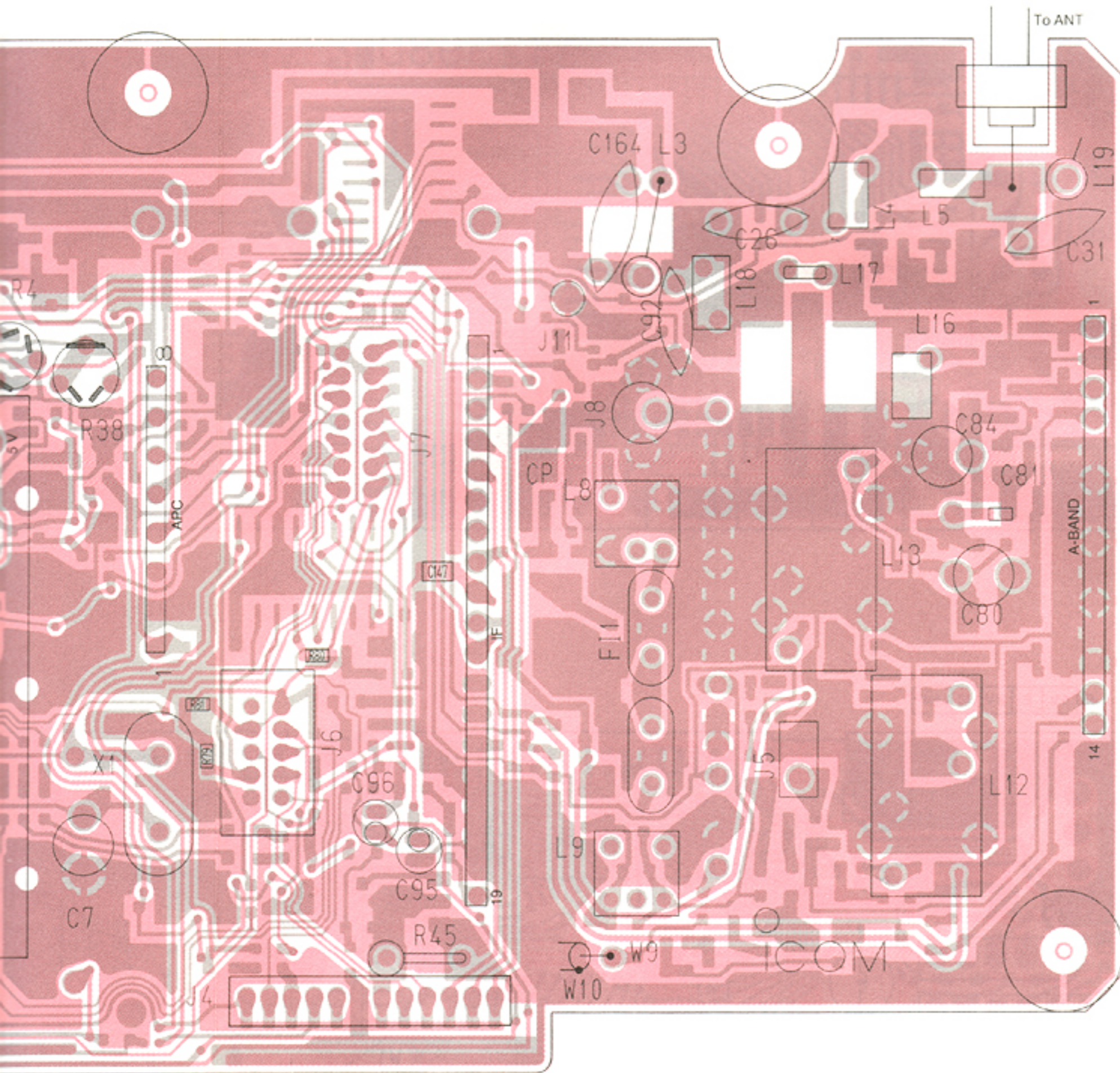
Symbol: A3



# 8-2 MAIN UNIT

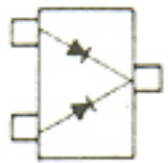






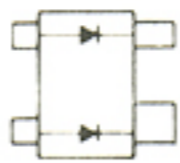
STB CC
SI
STONE
P/S
NC
E
LAMP
STBOD
STBOT
SQLC
SQLS
S/RF

**1SS184**  
D10, D13, D17



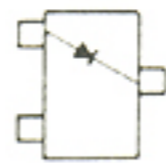
Symbol: B3

**MA862**  
D9



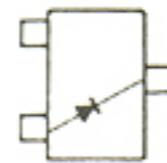
Symbol: M 11

**1SS153**  
D1, D12, D14



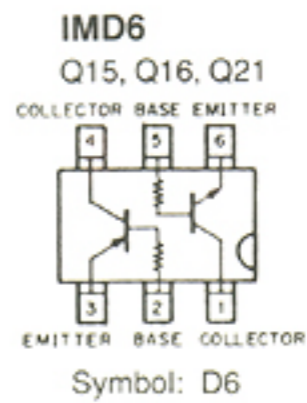
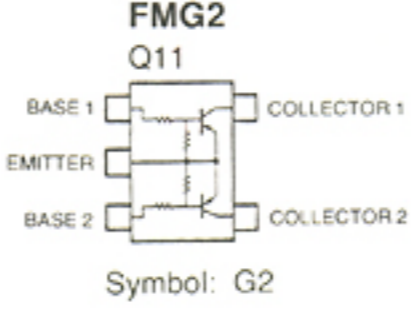
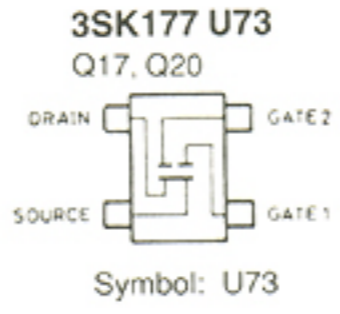
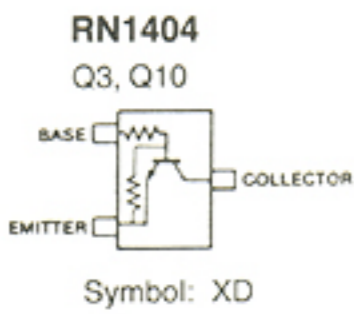
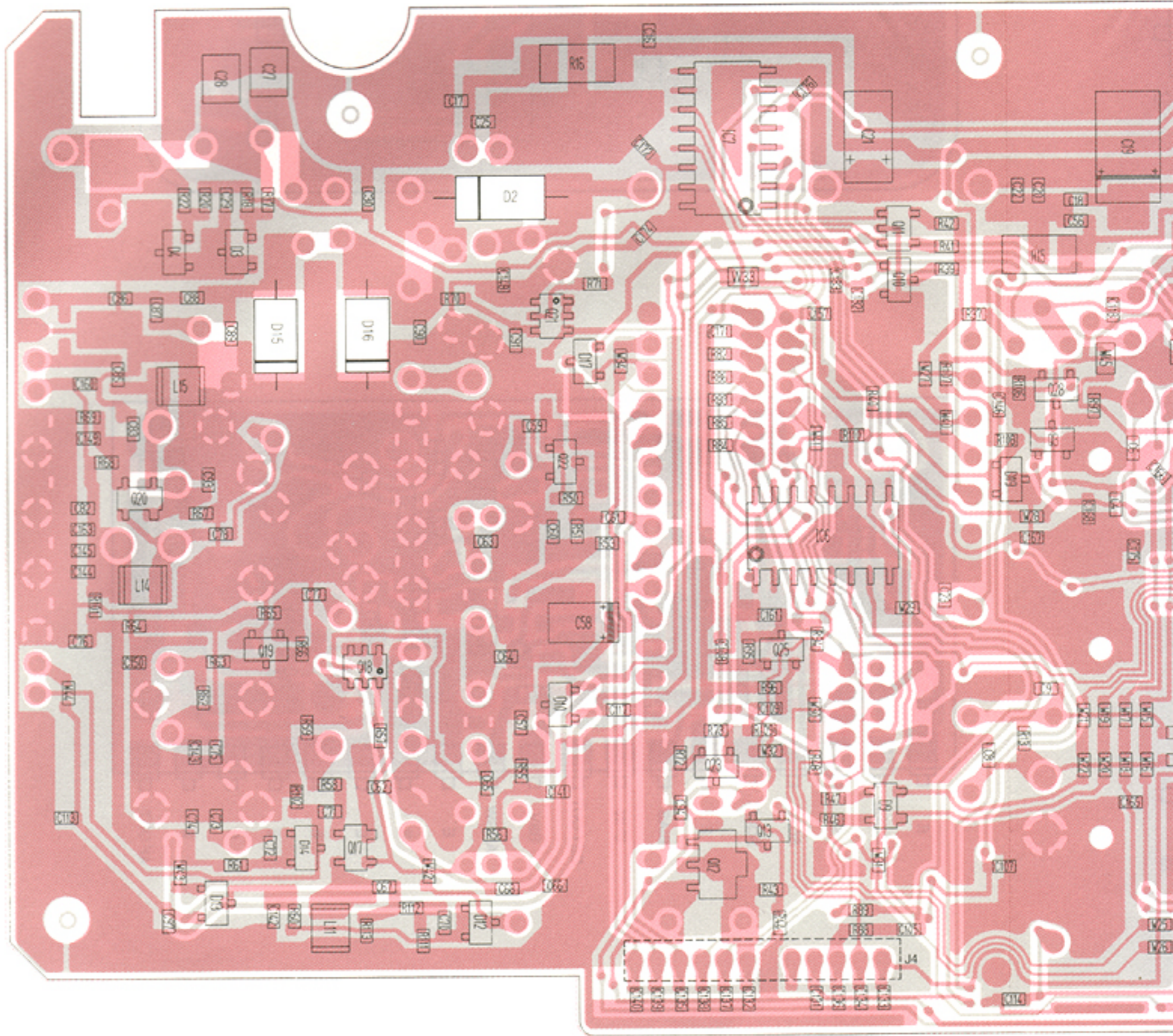
Symbol: A9

**1SS196**  
D11

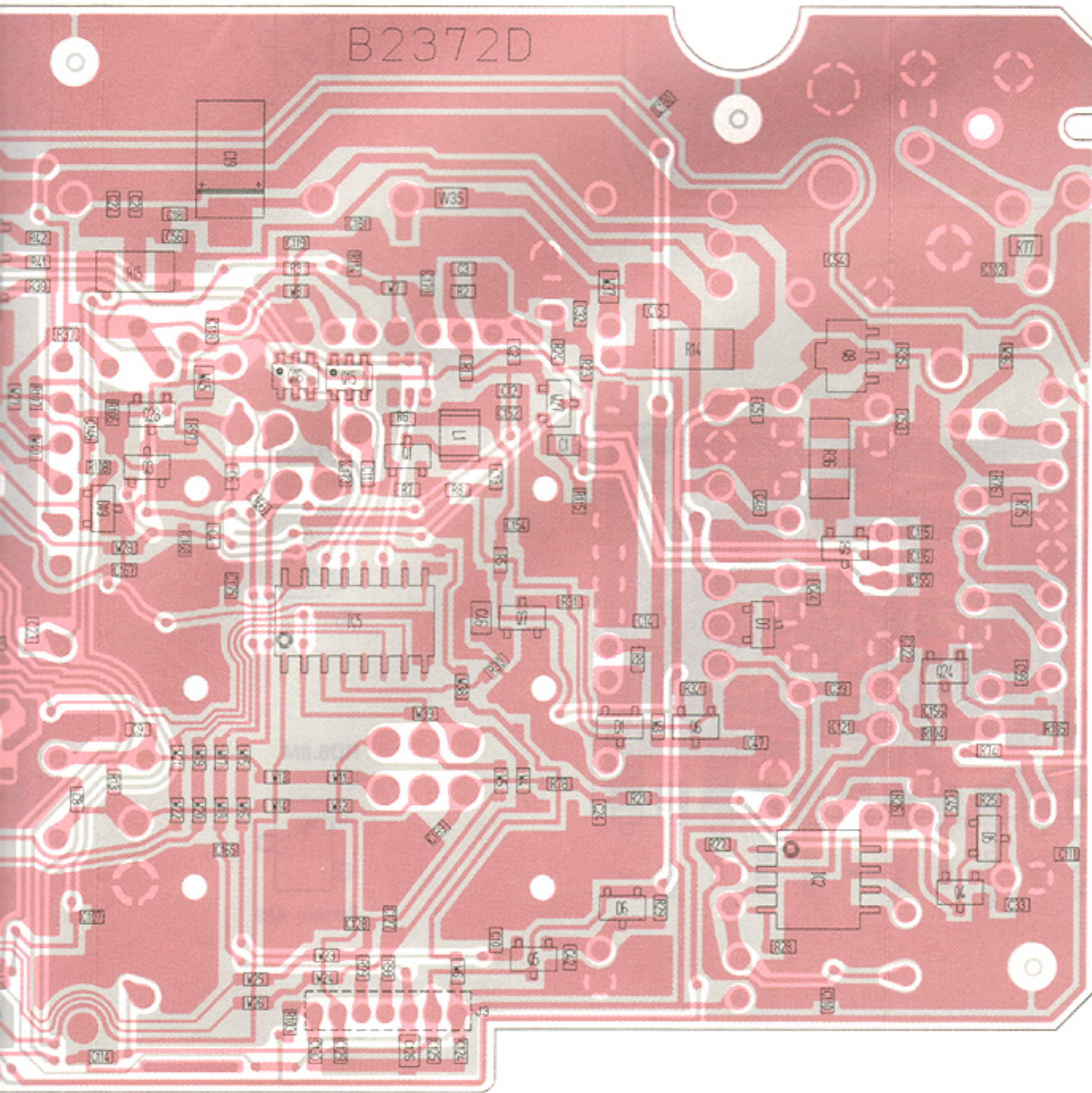


Symbol: G3

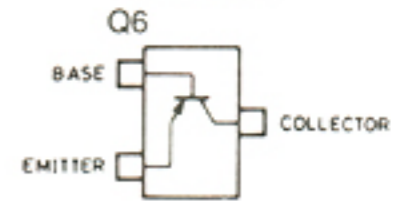






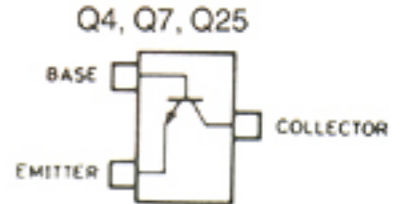


**2SA1362**



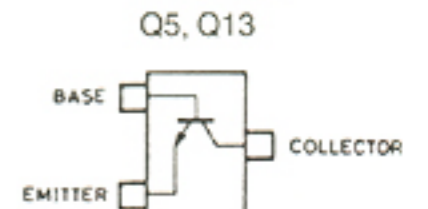
Symbol: AEG

**2SC2712Y**



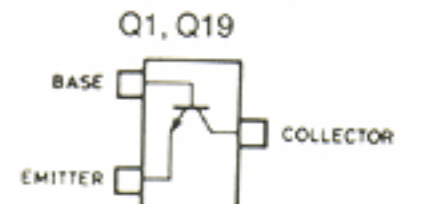
Symbol: LY

**2SC3661**



Symbol: FY

**2SC3775 3**



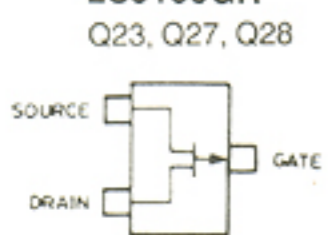
Symbol: OY3

**2SA1736**



Symbol: LD

**2SJ106GR**



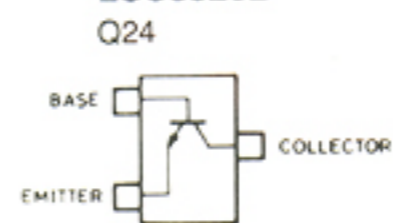
Symbol: VG

**2SC3770 3**



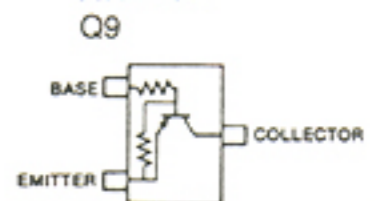
Symbol: JY3

**2SC3326B**



Symbol: CCB

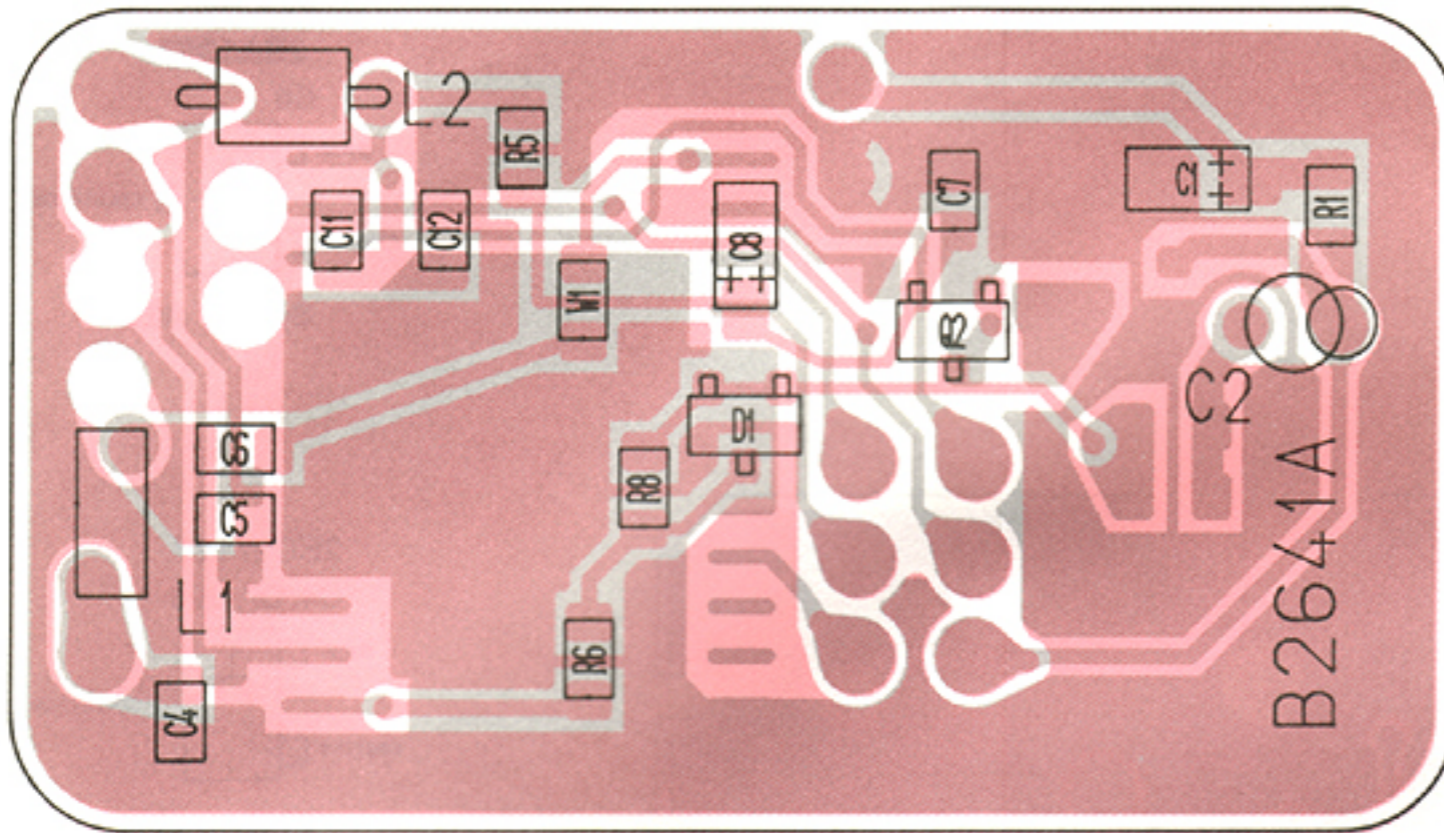
**RN2404**



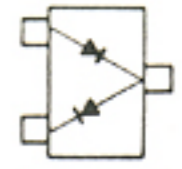
Symbol: YD



### 8-3 PLL-A UNIT

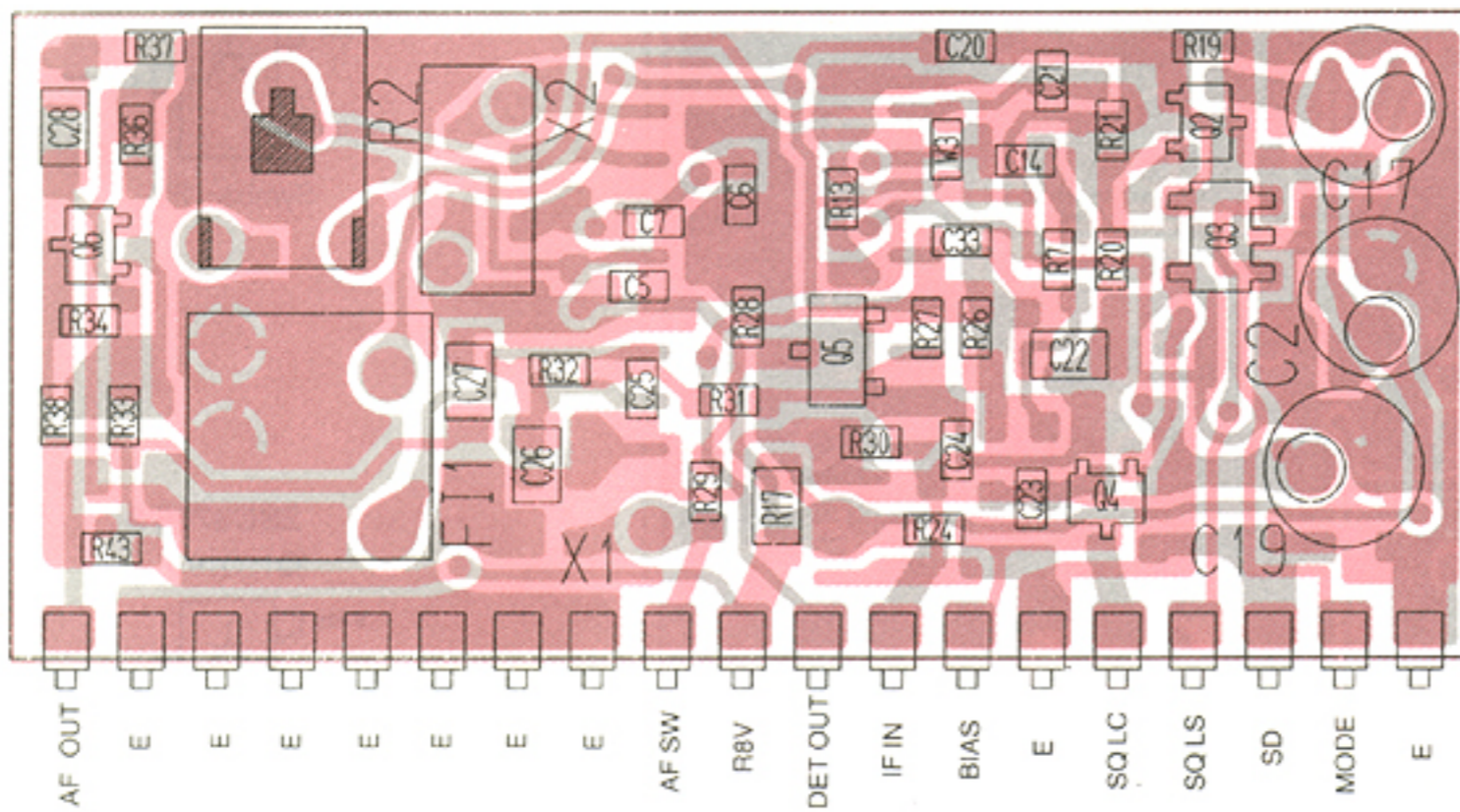


HSM88AS  
D1

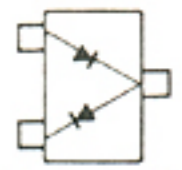


Symbol: C1

### 8-4 IF UNIT

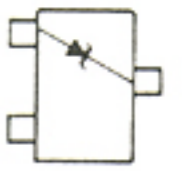


HSM88AS  
D2



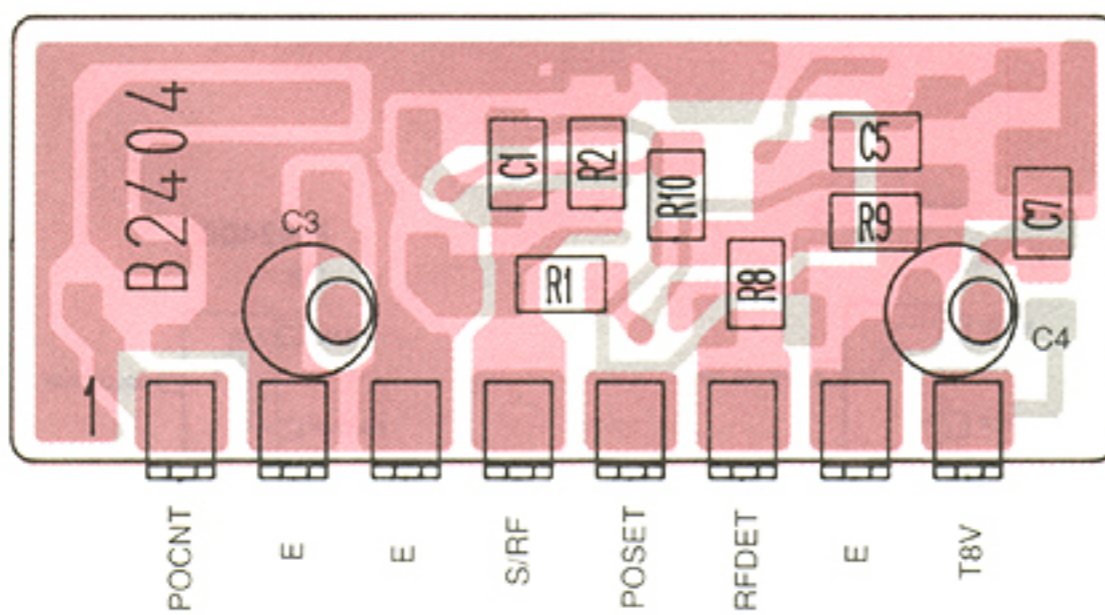
Symbol: C1

RD6.8M  
D1

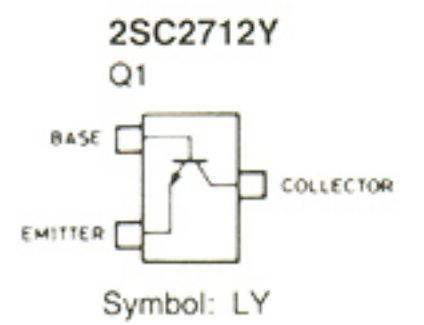
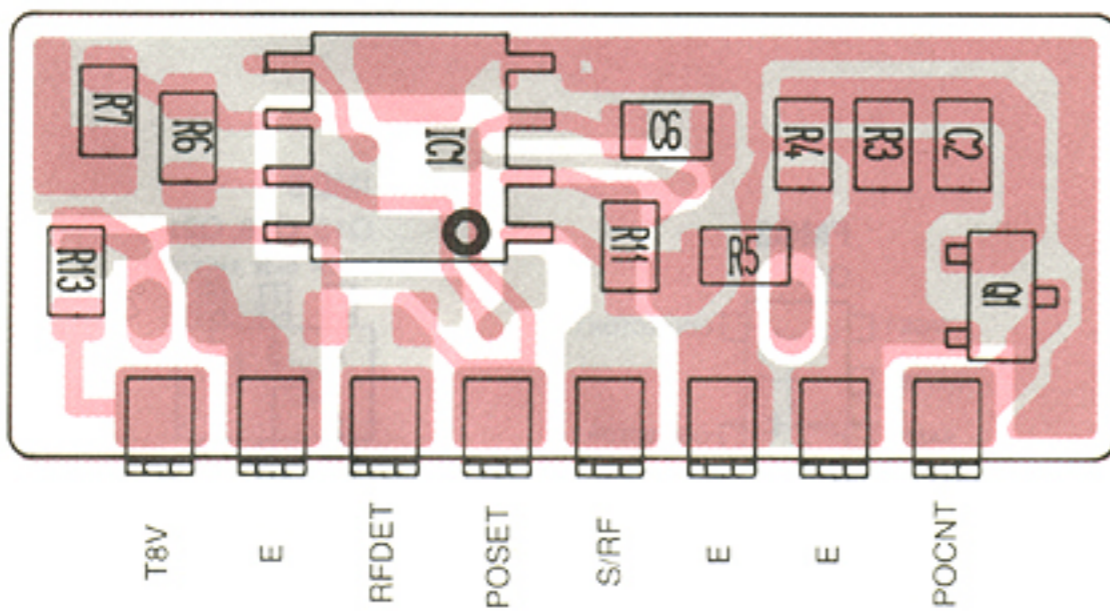
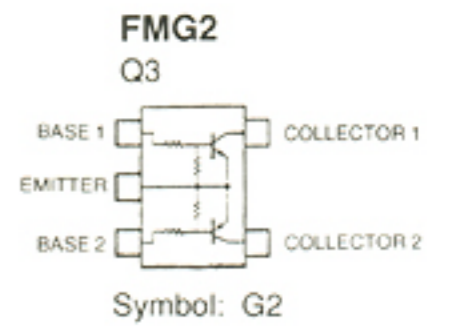
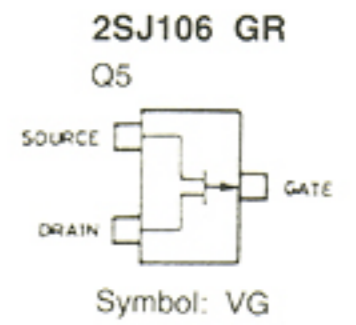
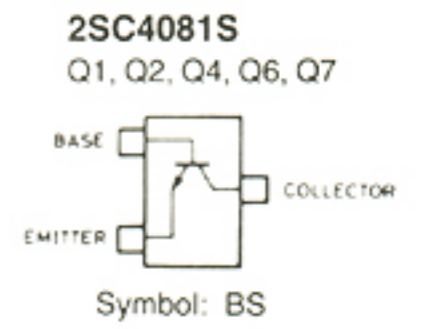
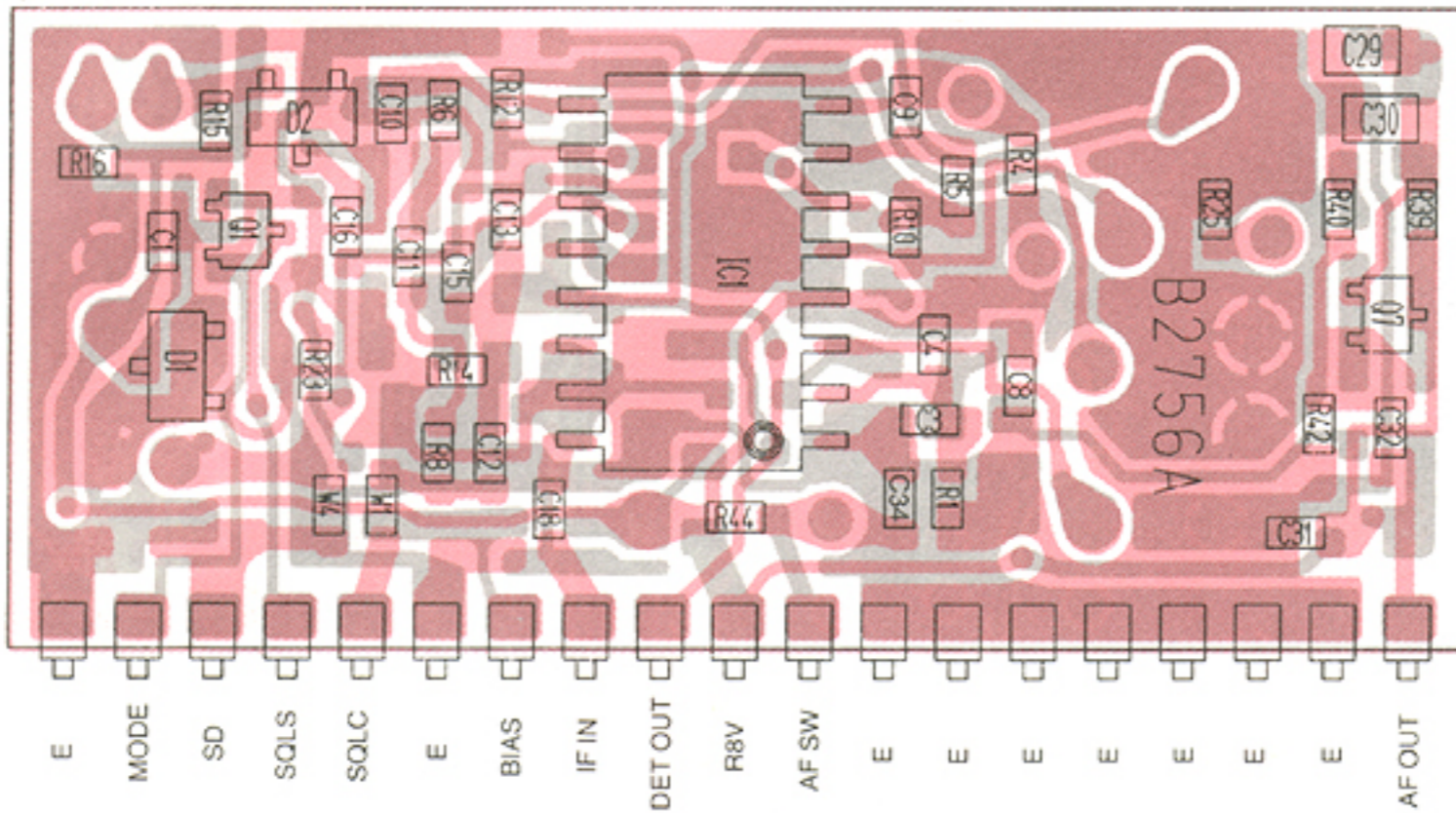
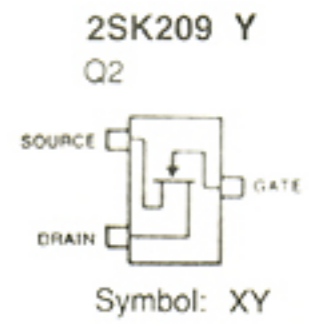
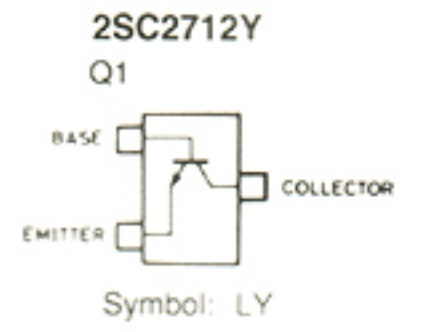
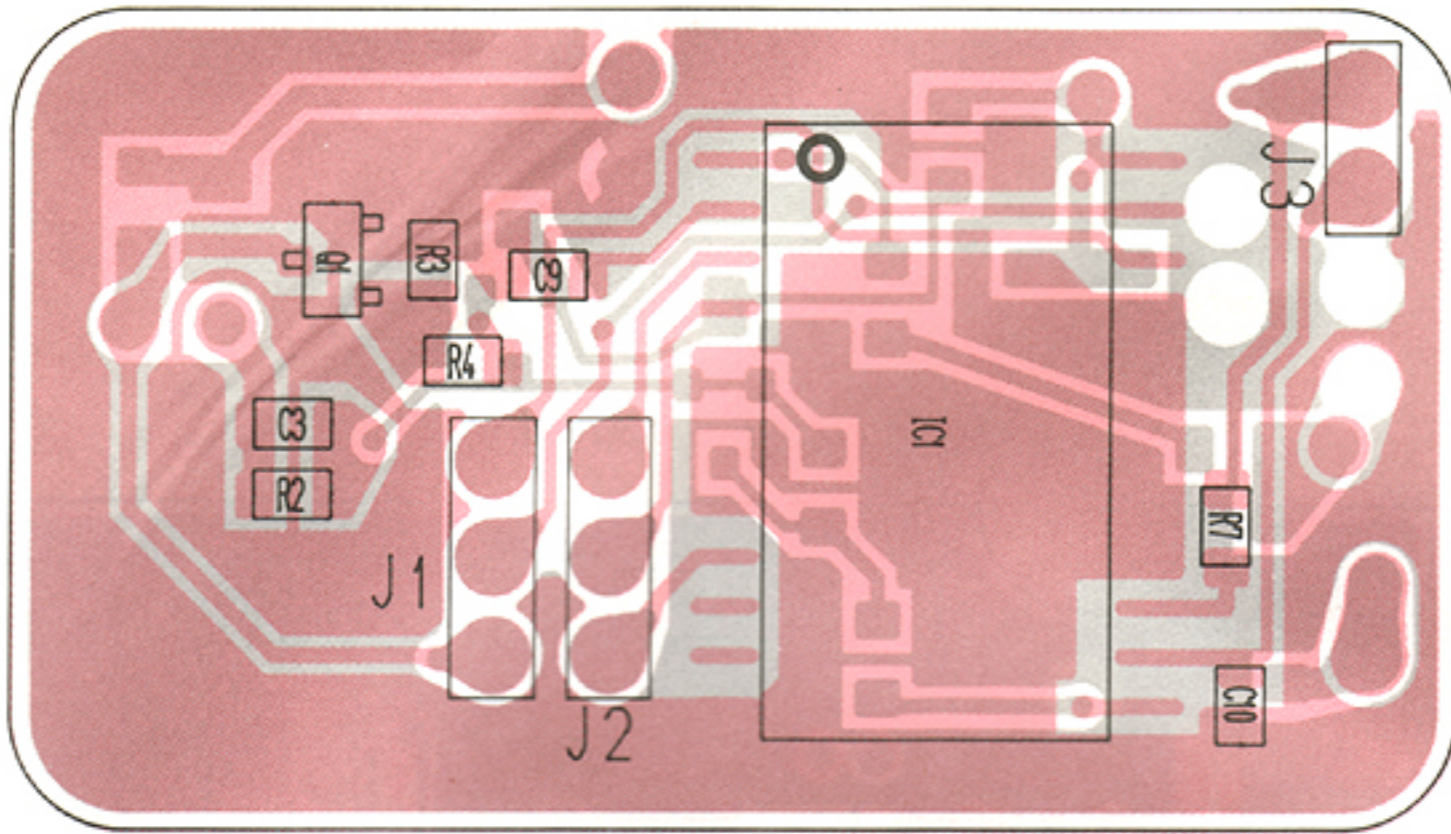


Symbol: 682

### 8-5 APC UNIT

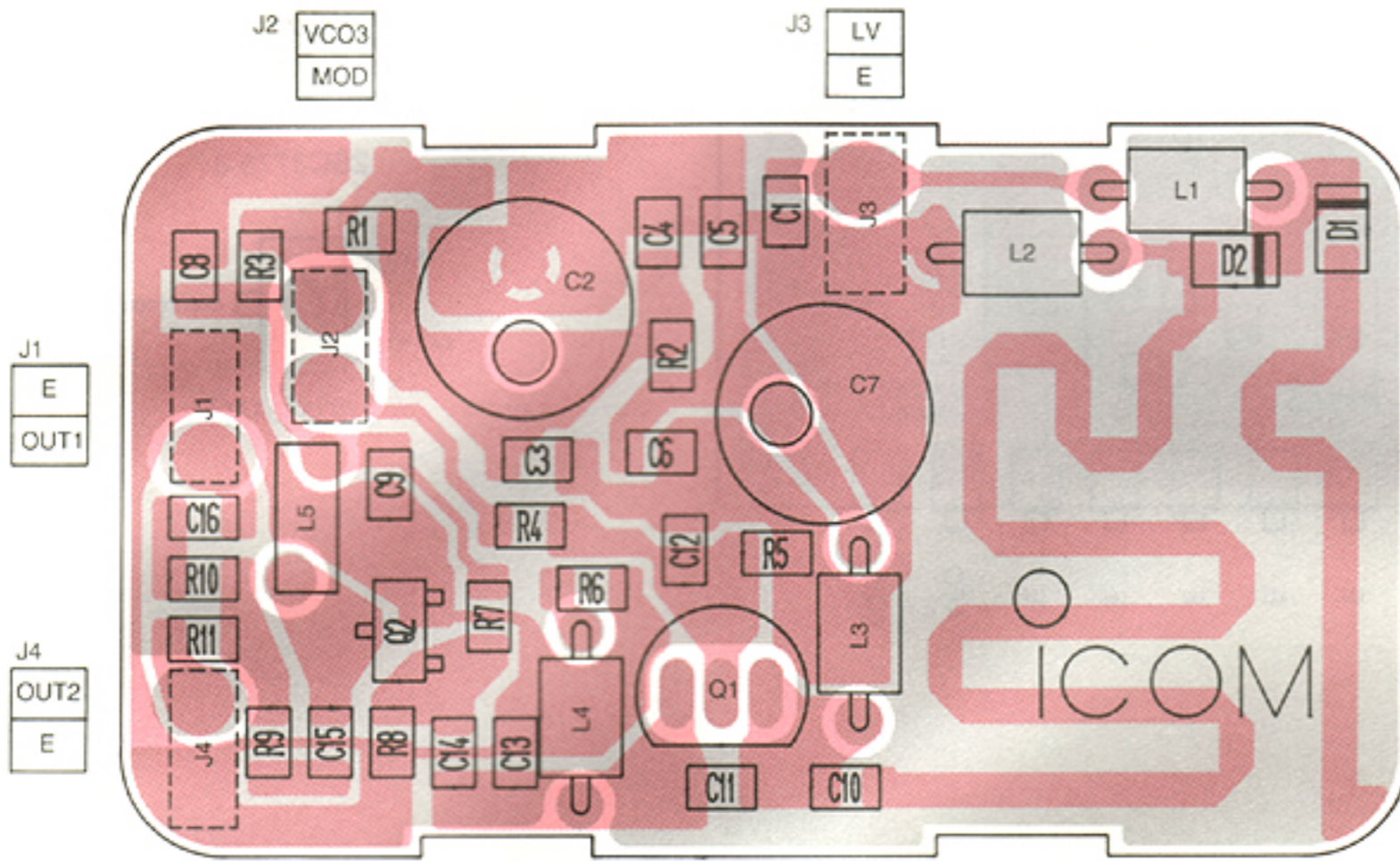




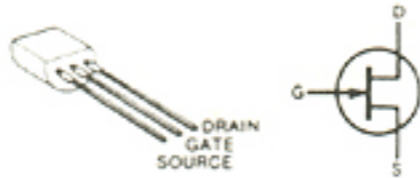




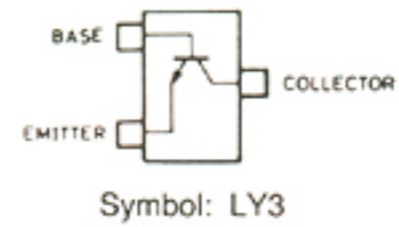
## 8-6 VCO UNIT



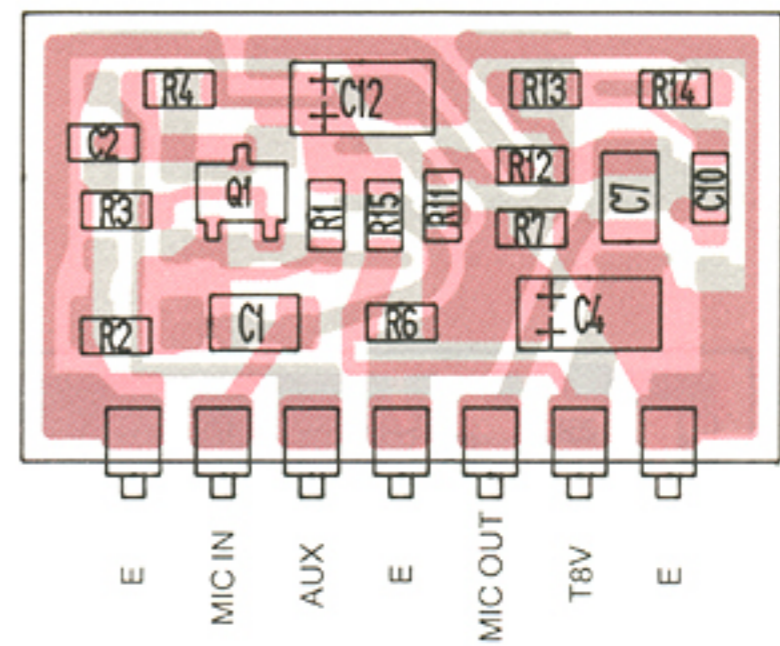
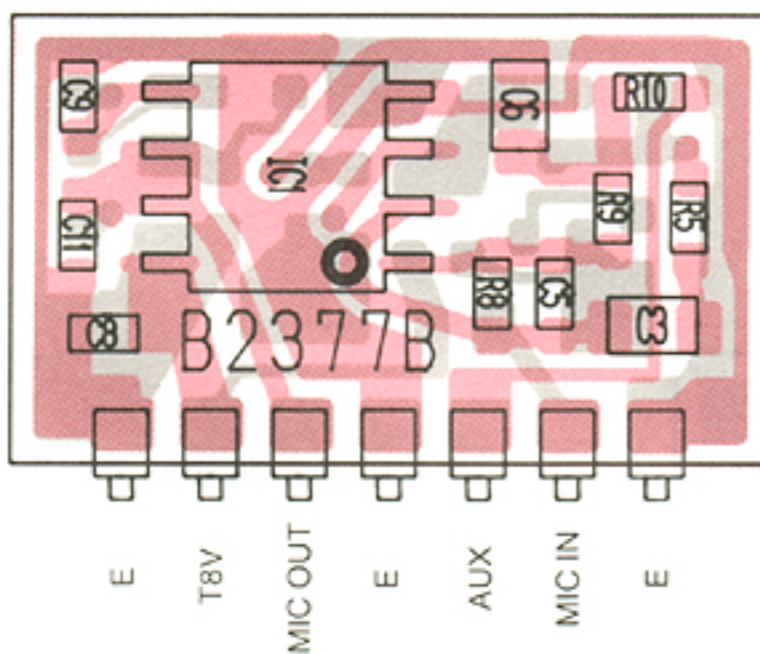
2SK125  
Q1



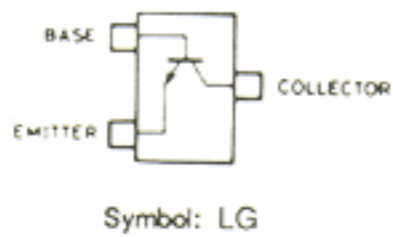
2SC3772 3  
Q2



## 8-7 MIC-AMP UNIT

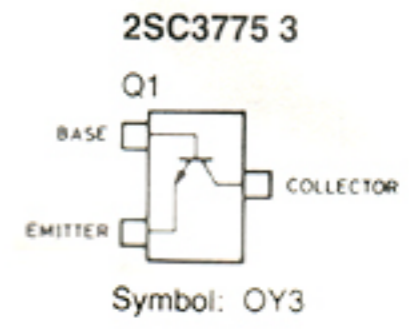
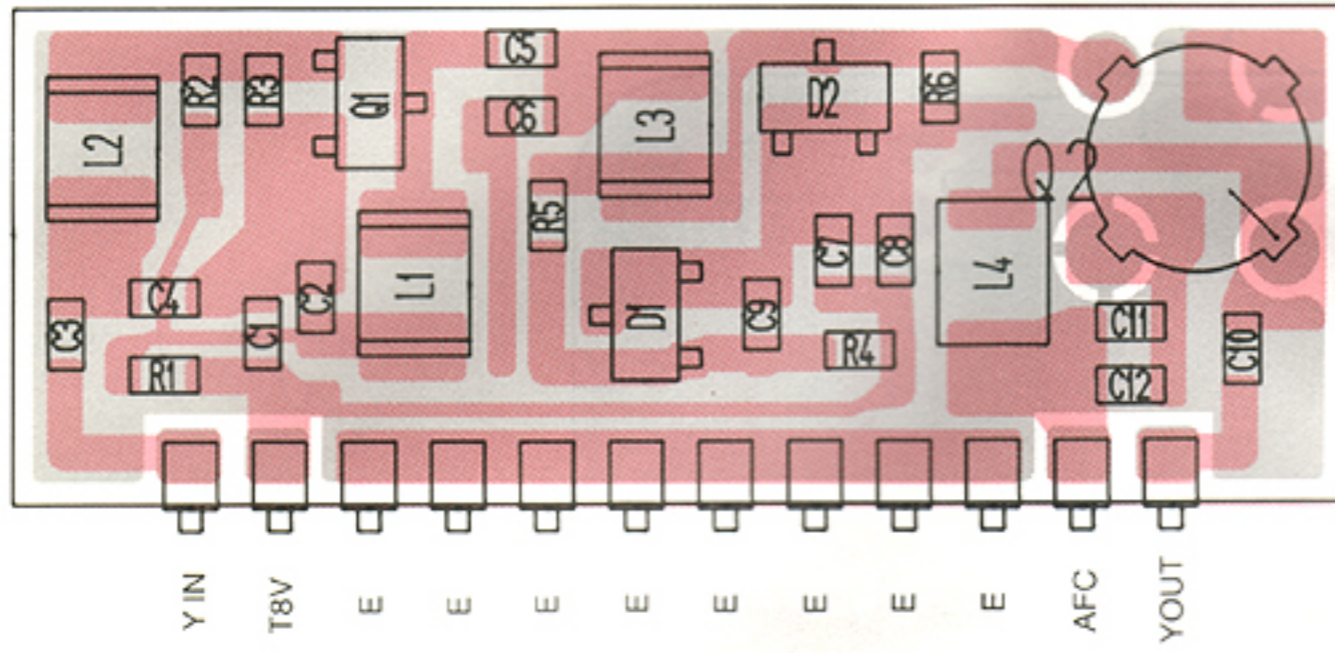


2SC4116GR  
Q1

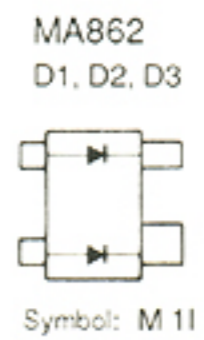
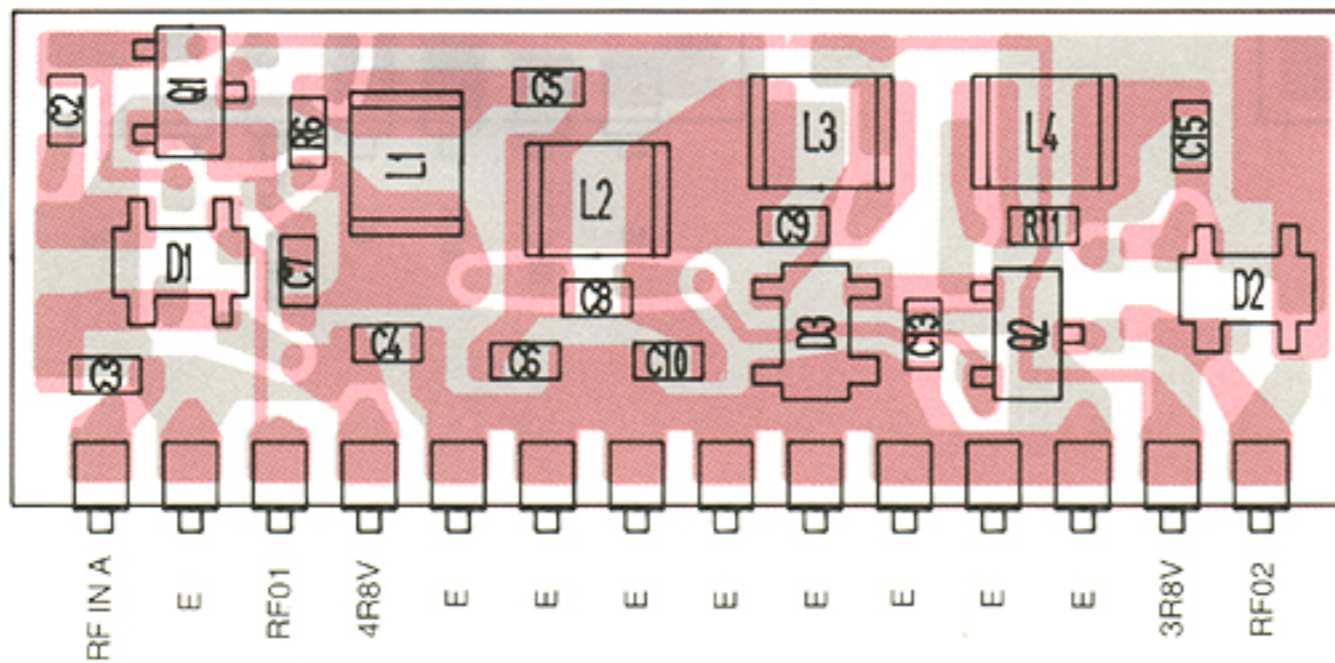
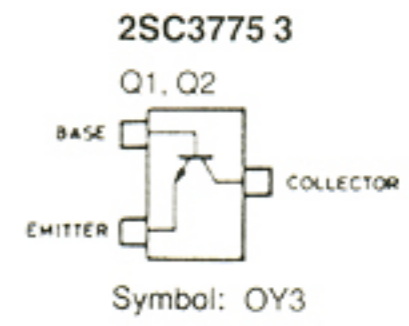
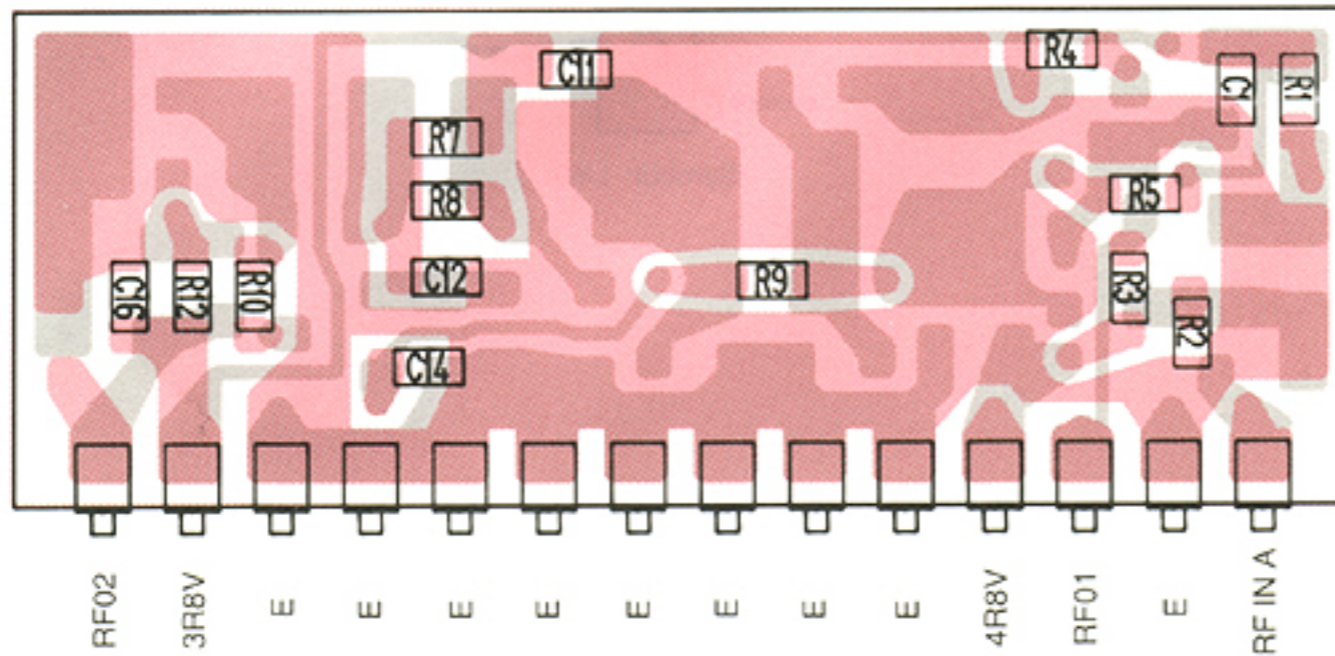




### 8-8 YGR UNIT

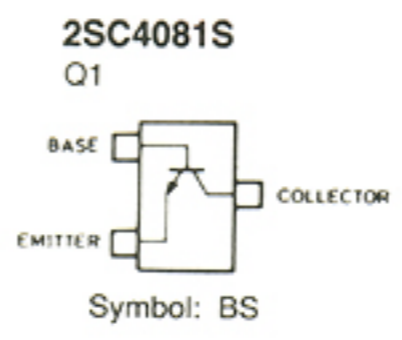
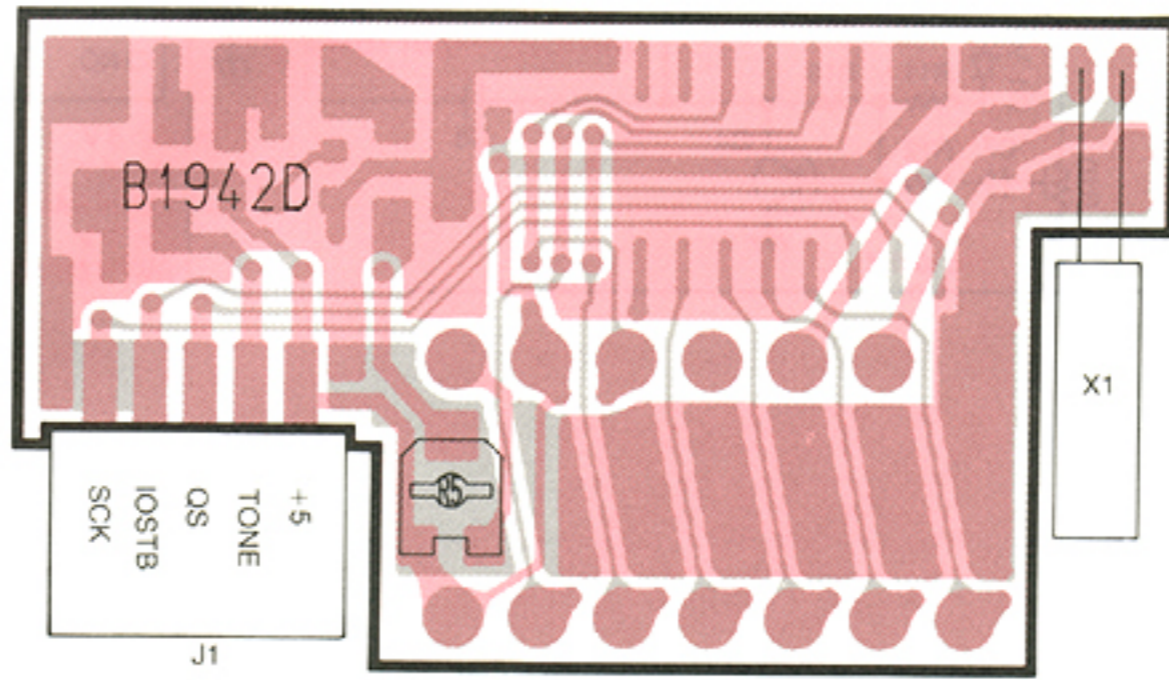
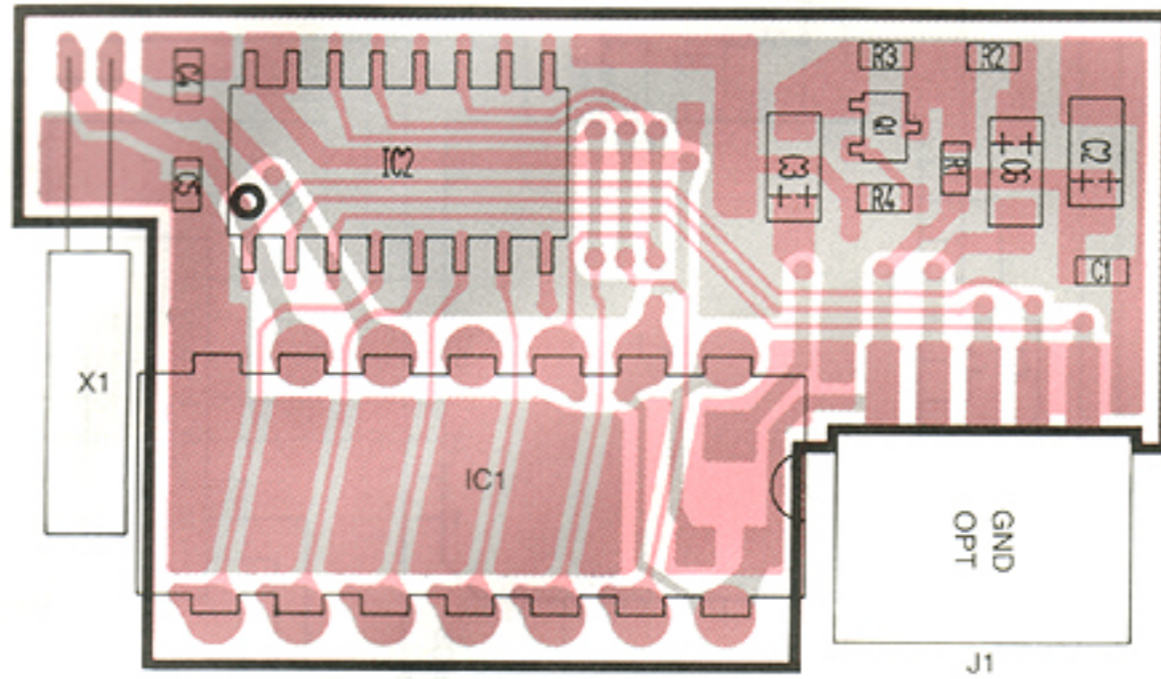


### 8-9 A-BAND UNIT





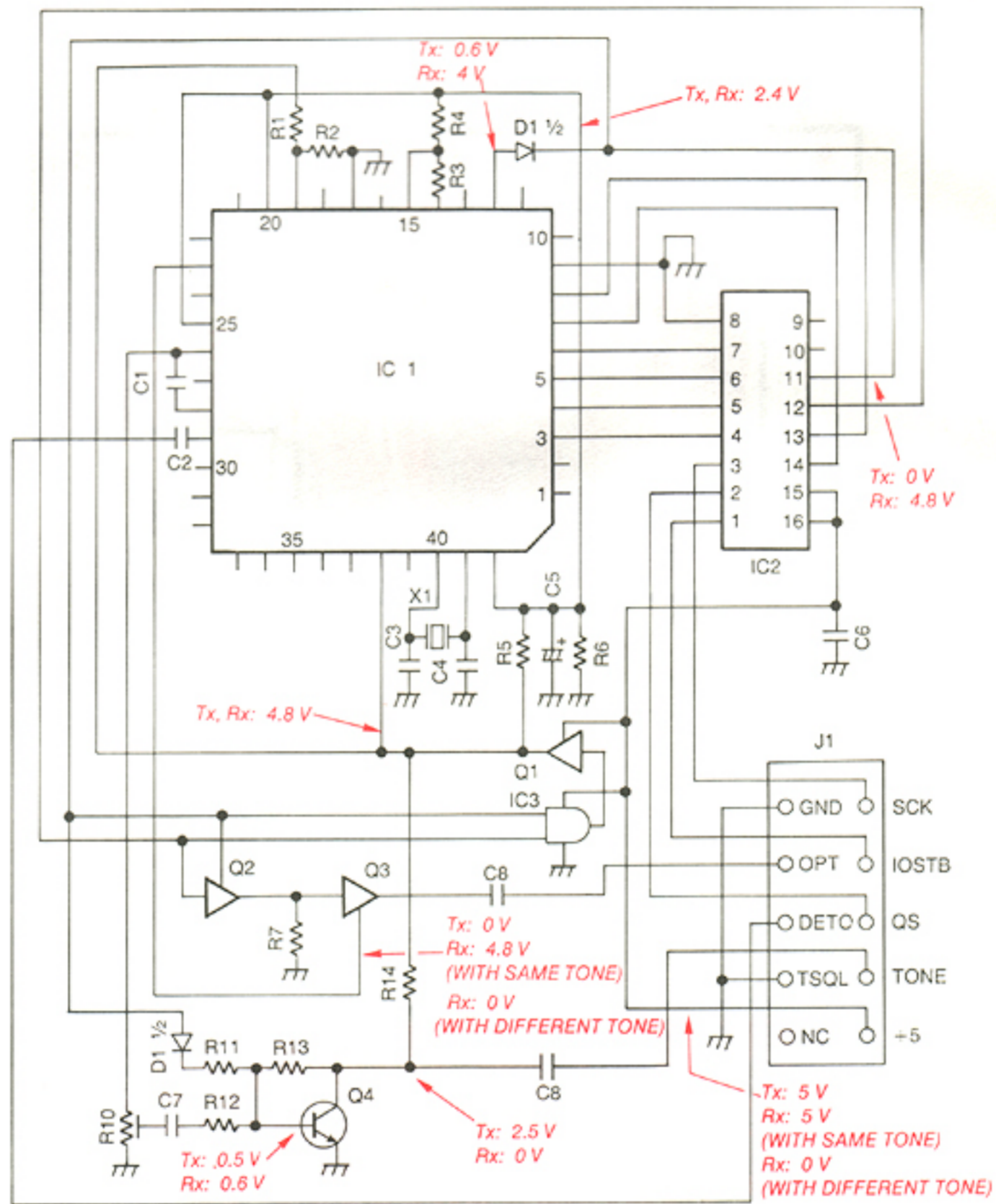
8-10 UT-51 TONE ENCODER UNIT



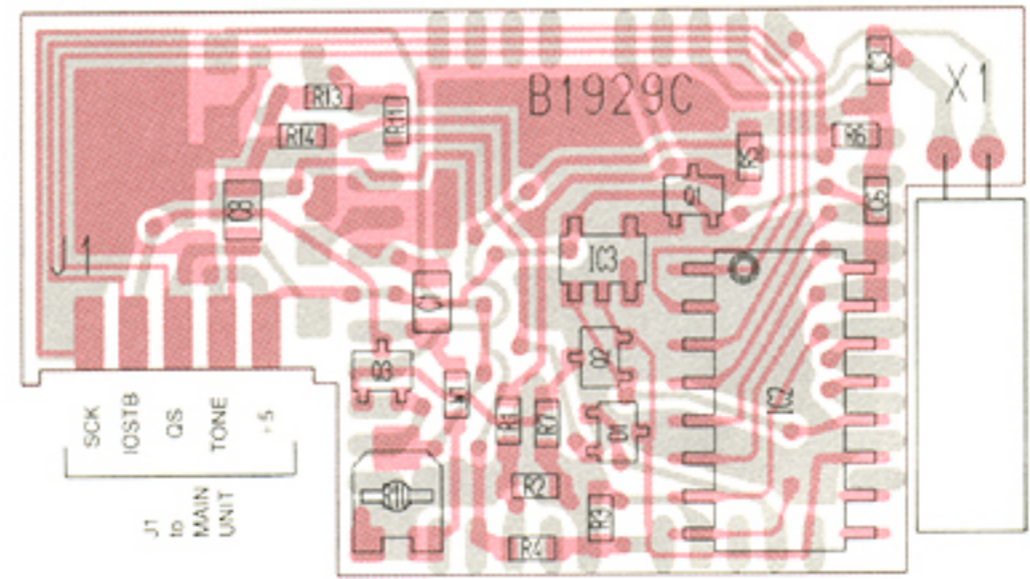
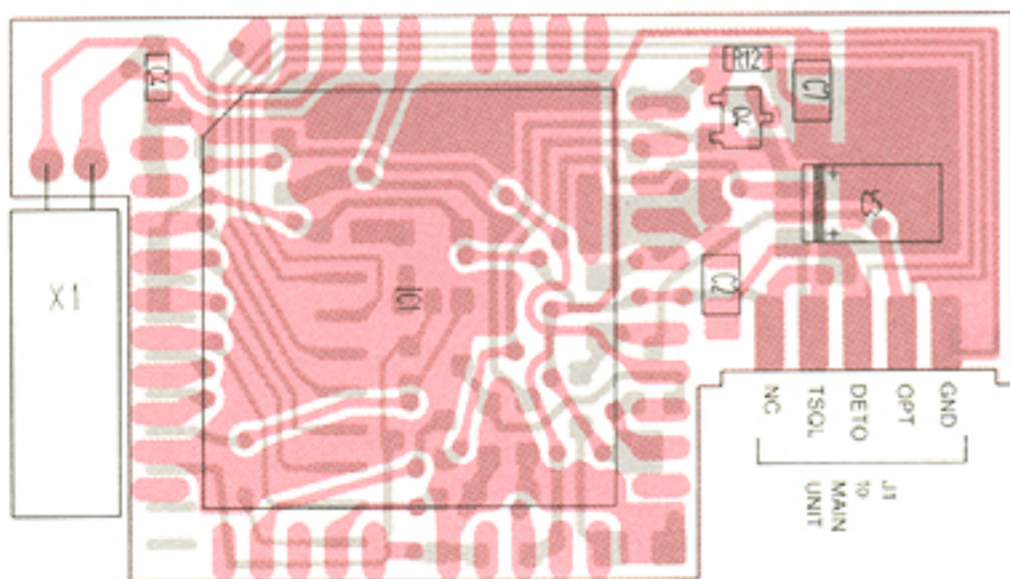


# SECTION 9 OPTION UNITS

## 9-1 UT-50 TONE SQUELCH UNIT

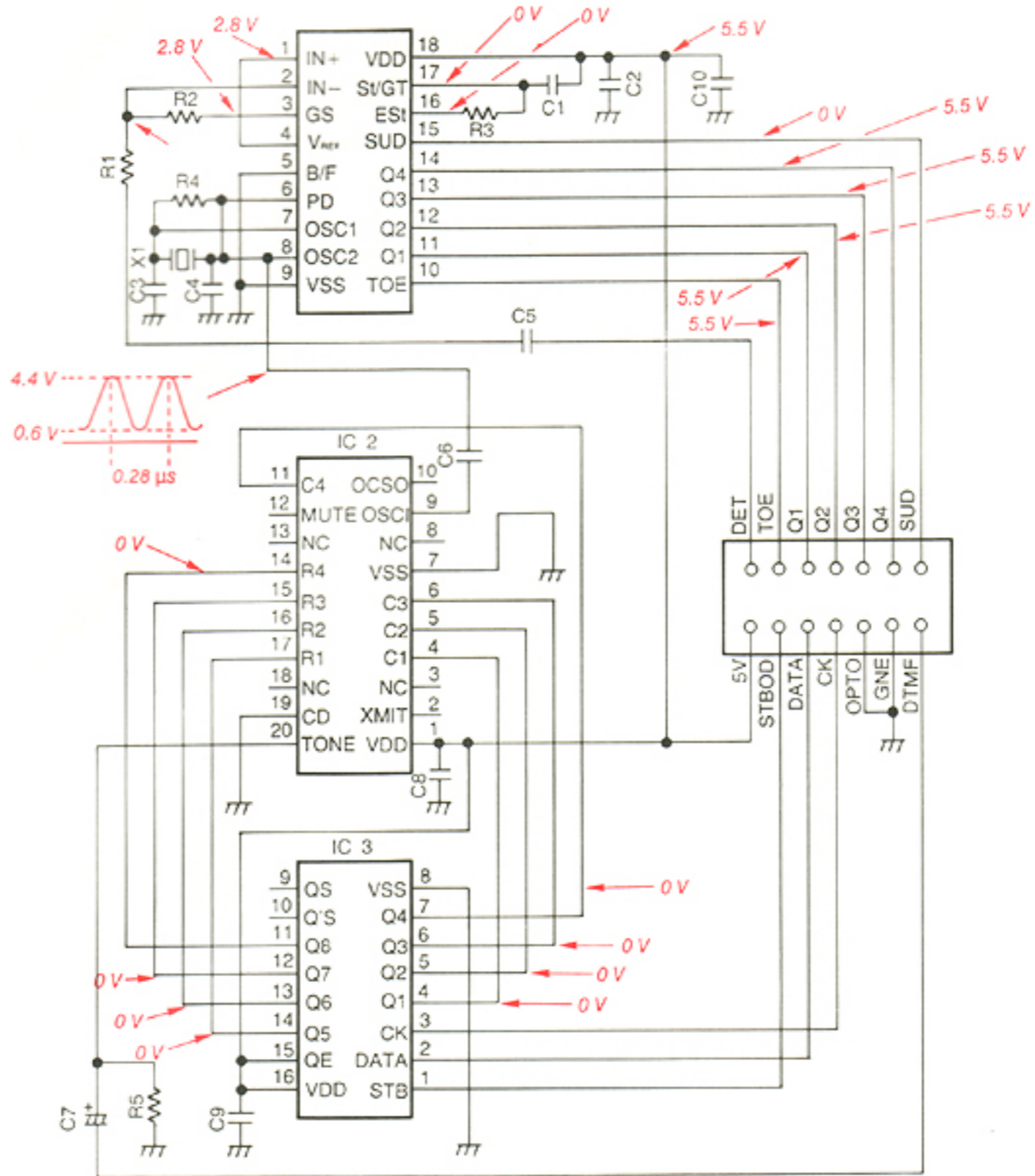


### •BOARD LAYOUTS

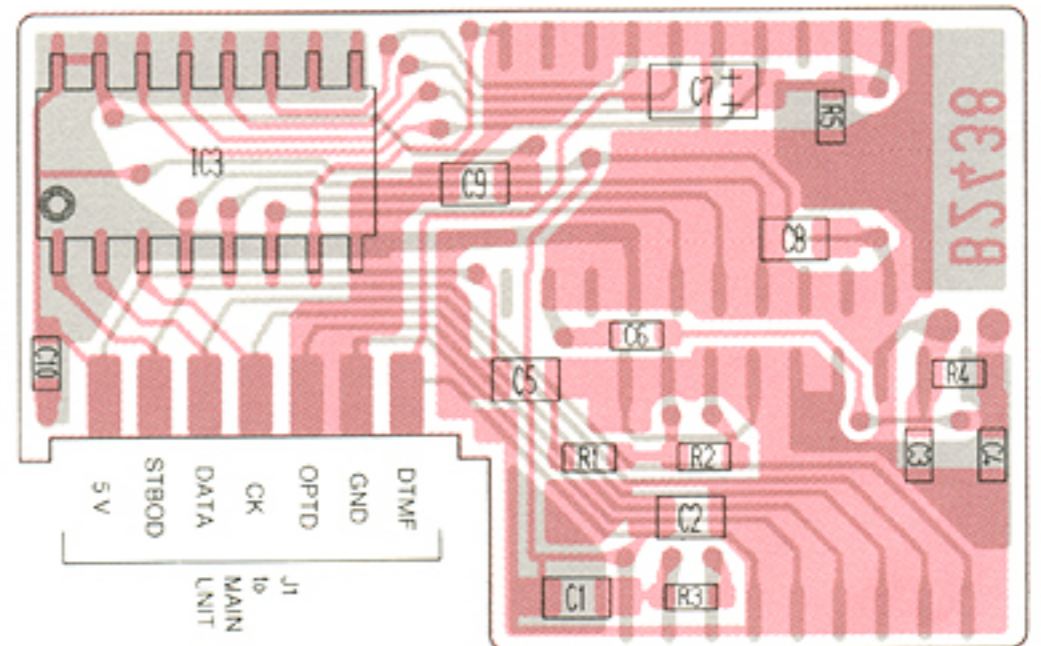
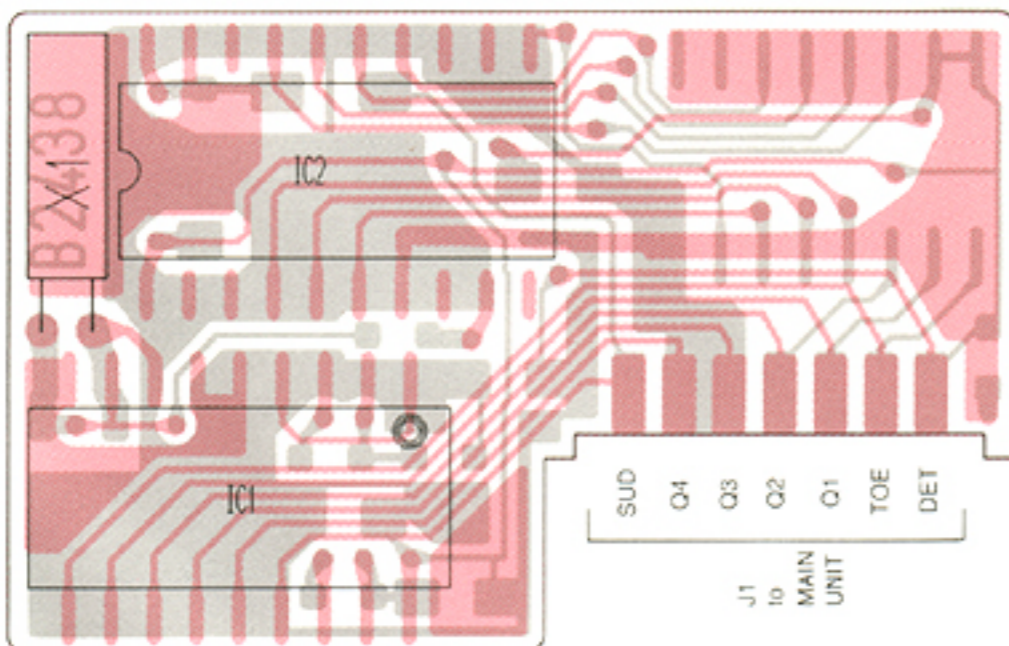




## 9-2 UT-55 DTMF ENCODER/DECODER UNIT

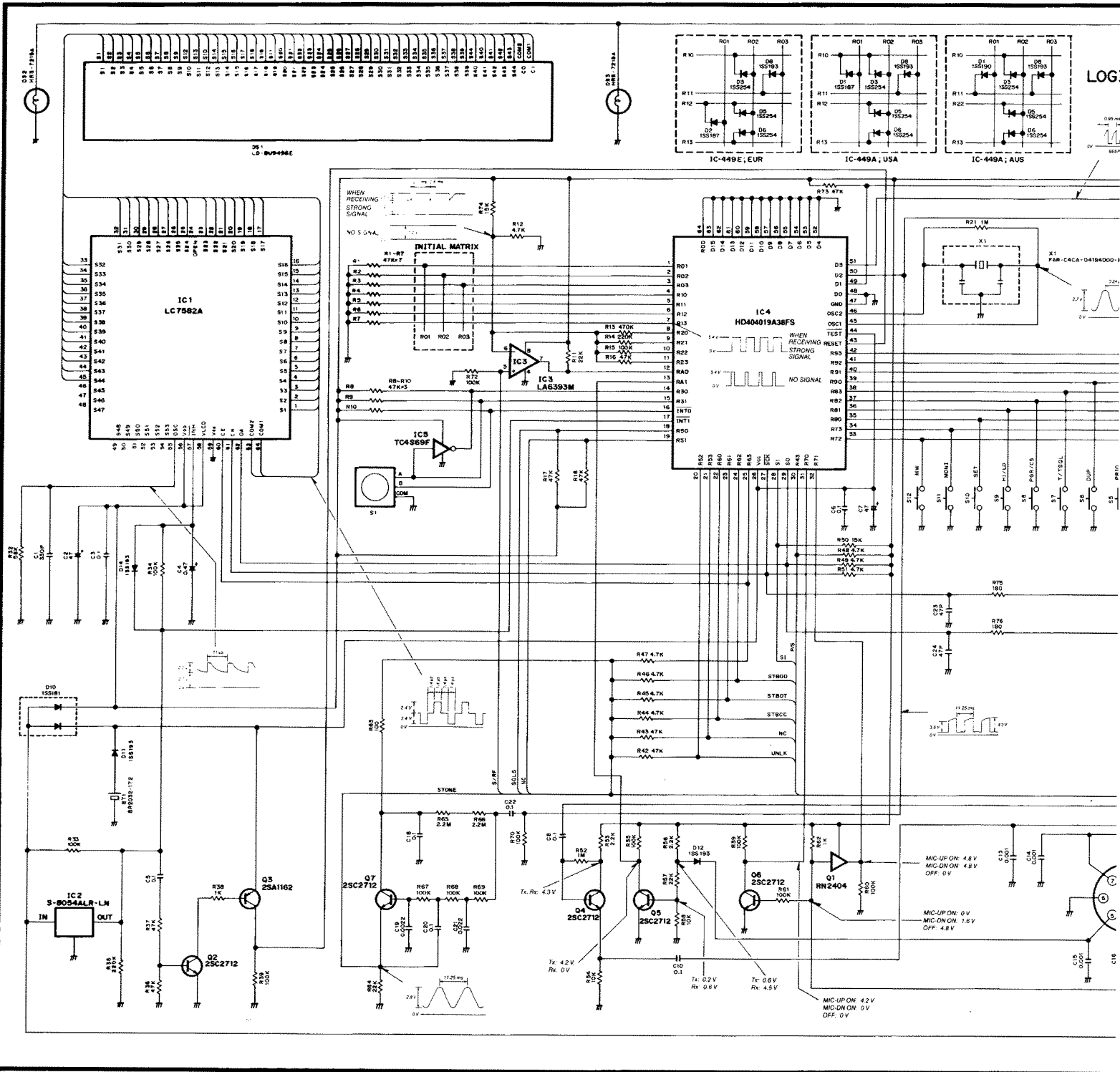


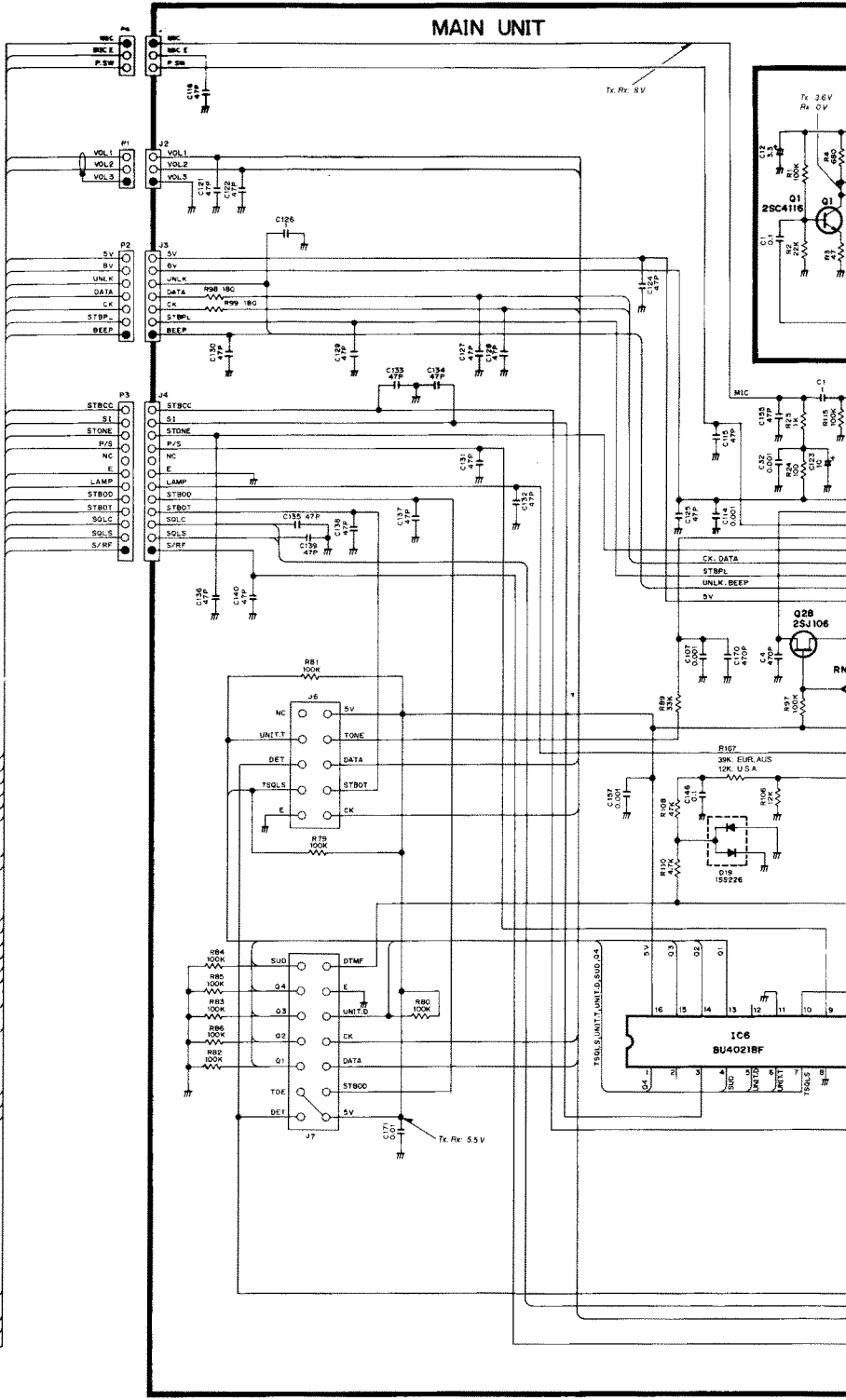
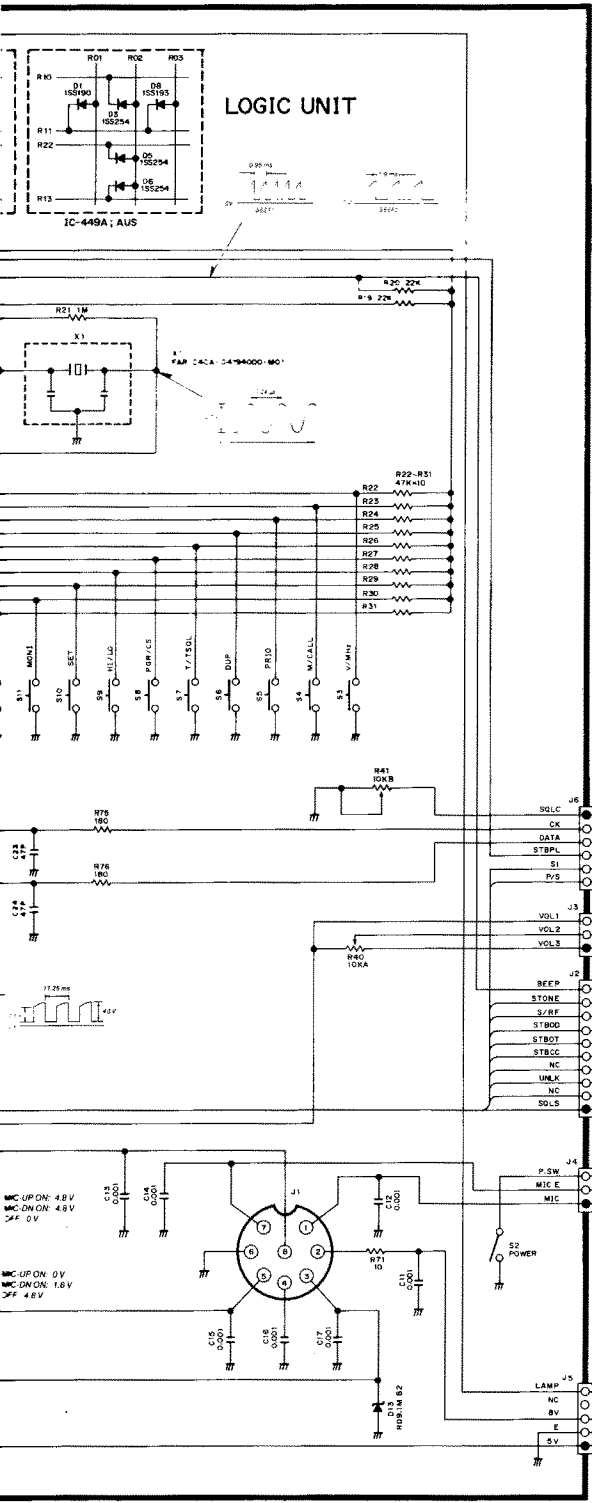
### • BOARD LAYOUTS

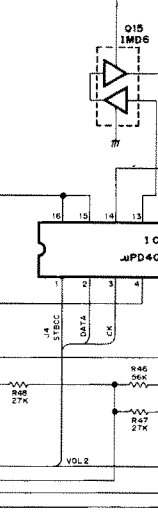
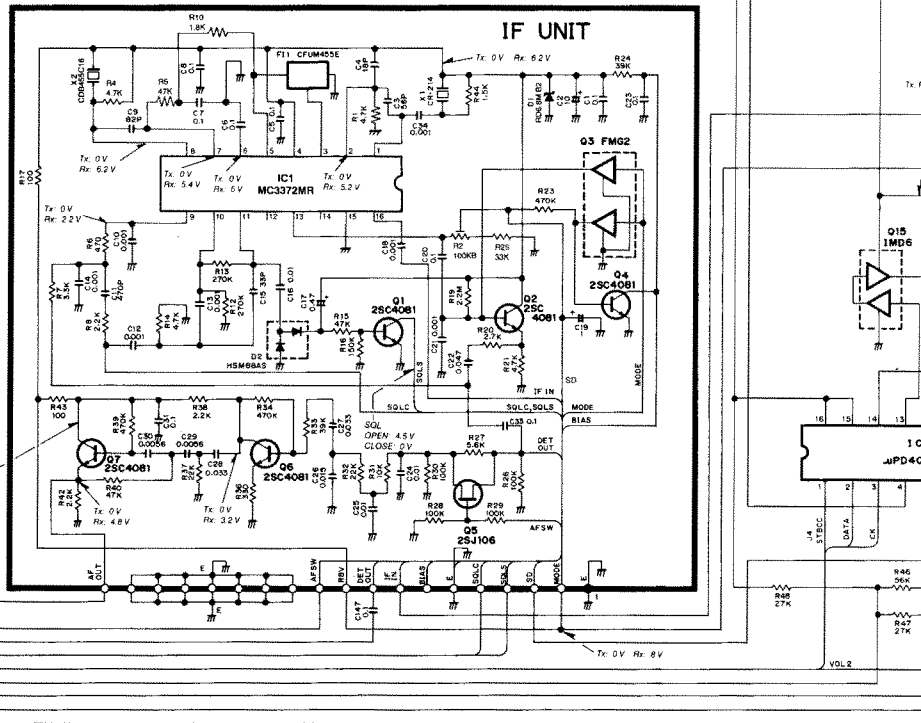
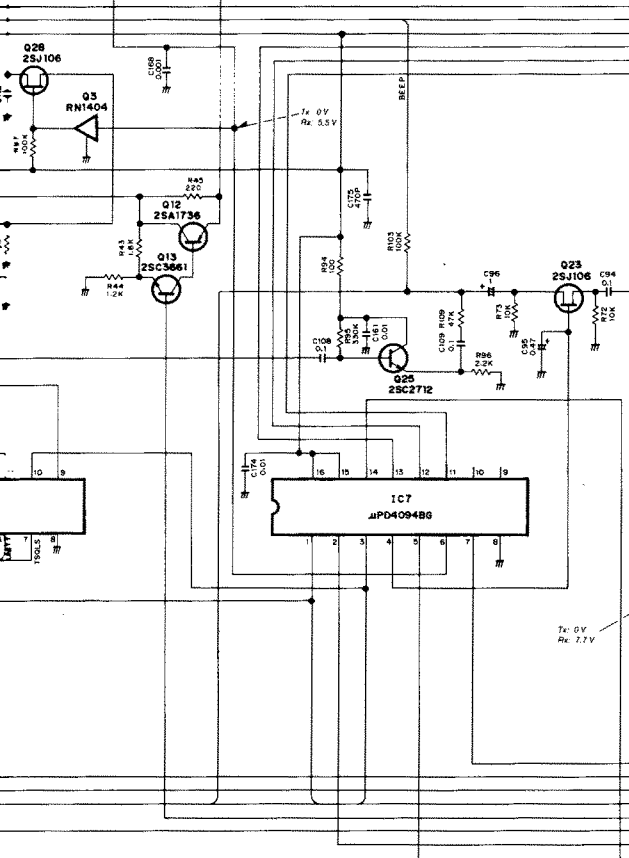
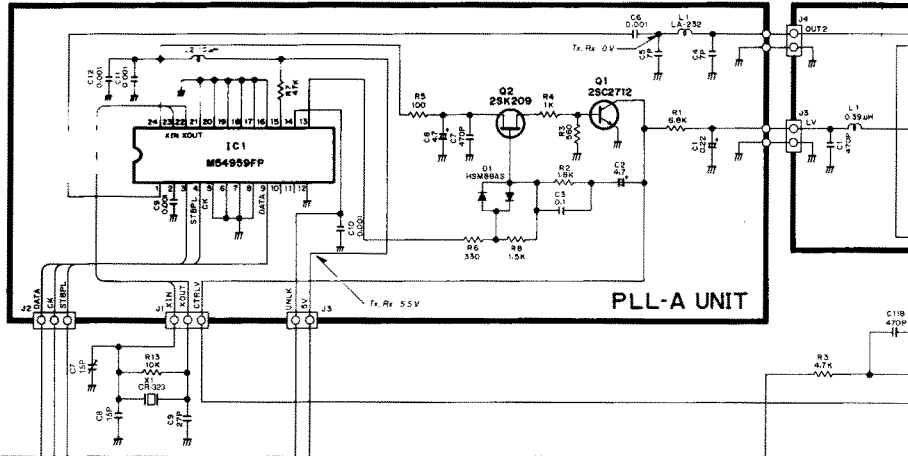
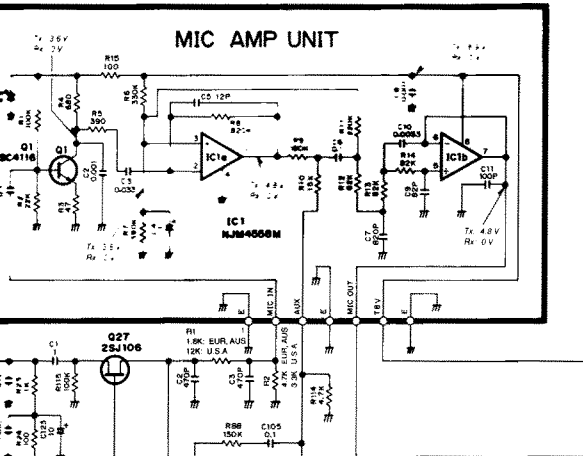


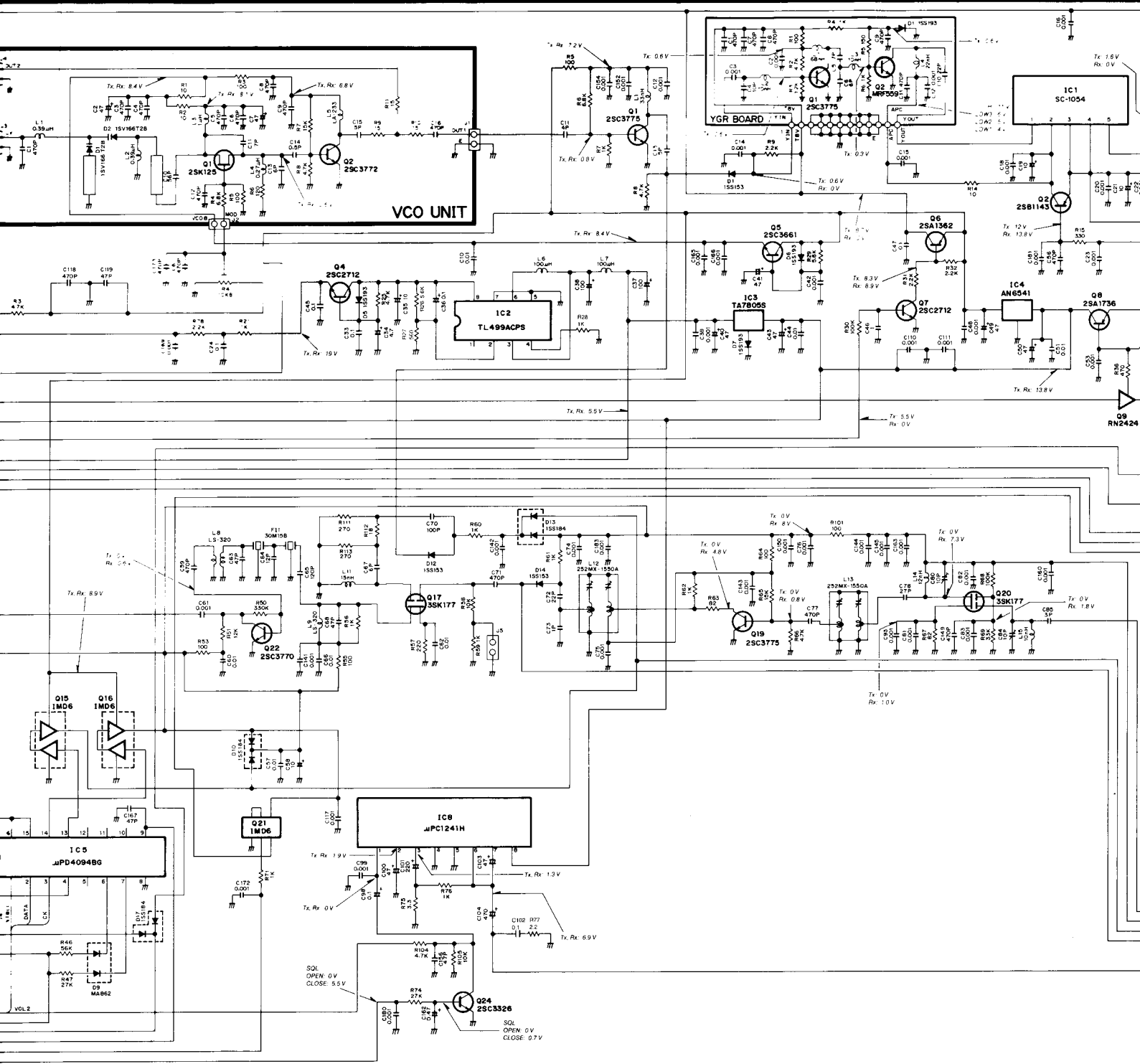


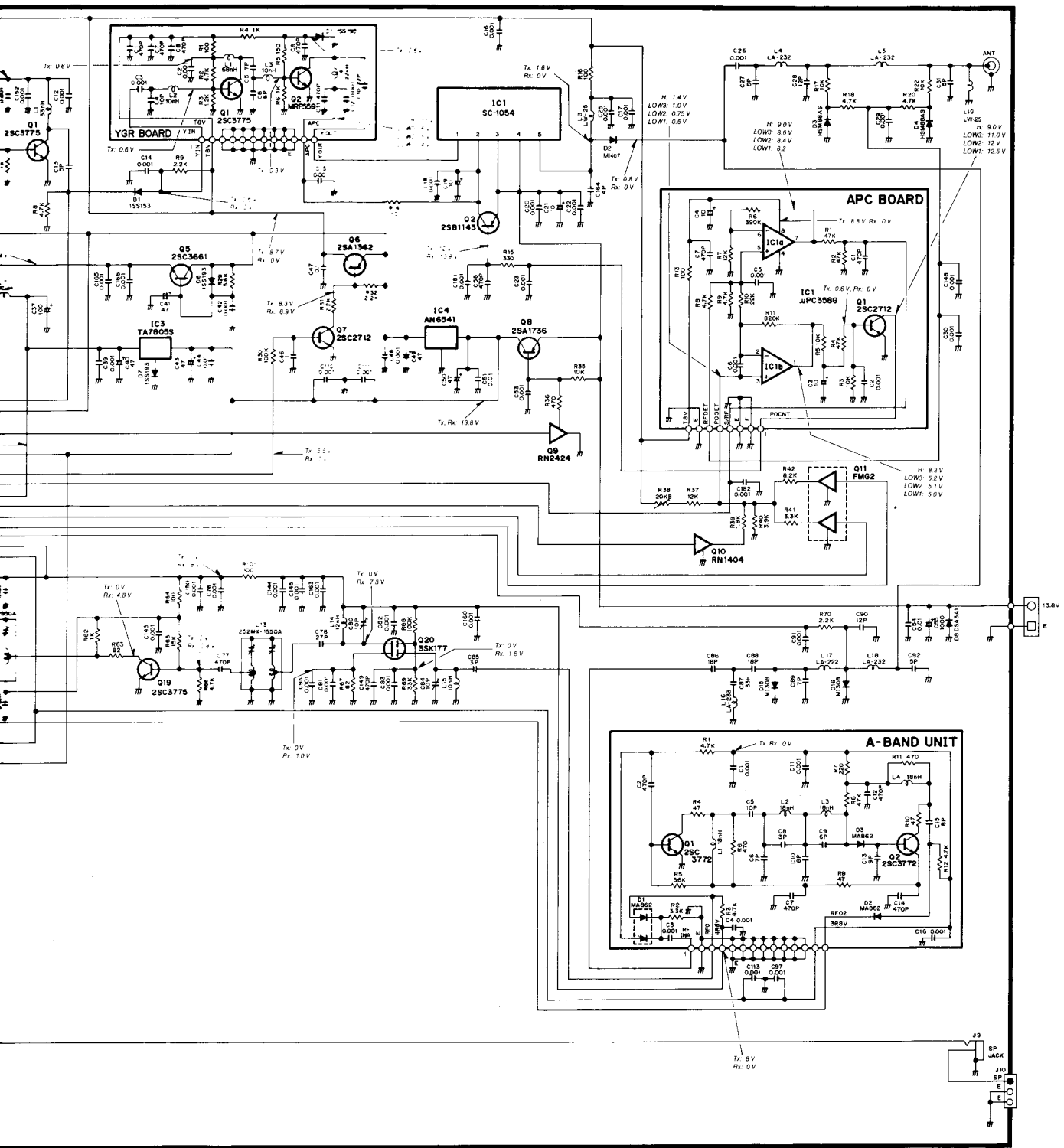
# SECTION 10 VOLTAGE DIAGRAM



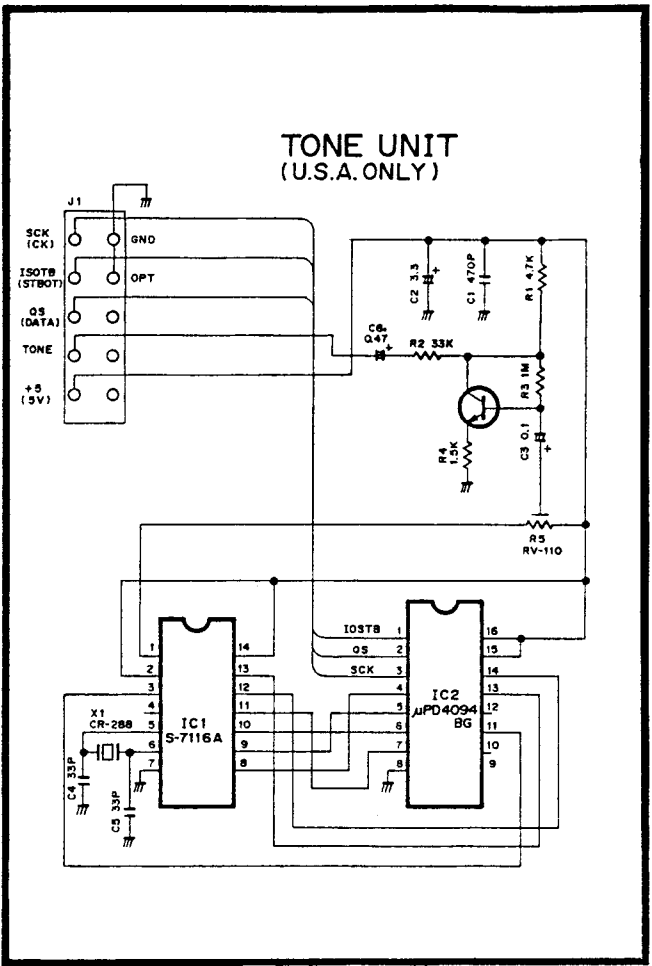






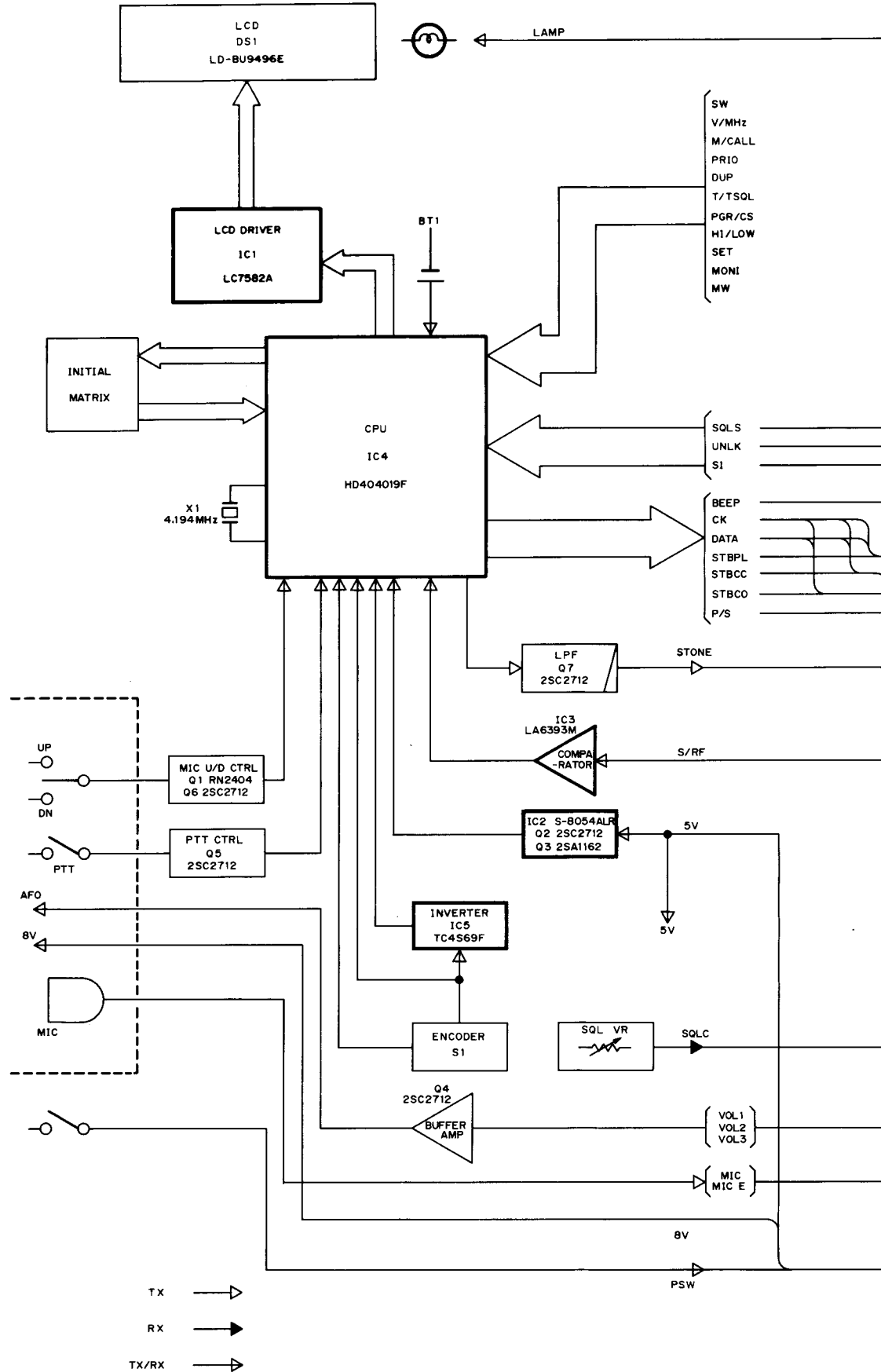


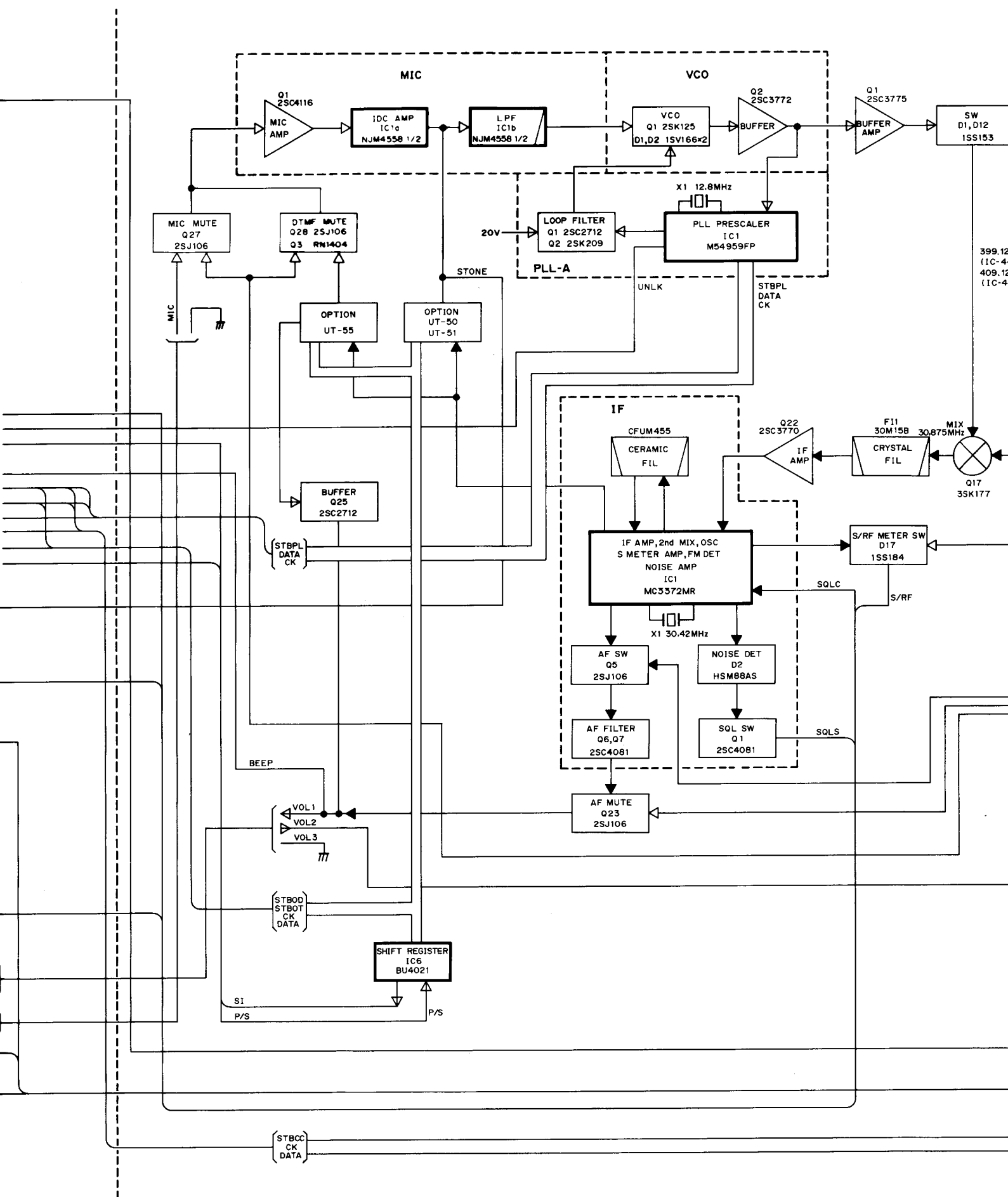
# TONE UNIT (U.S.A. ONLY)



# SECTION 11 BLOCK DIAGRAM

## LOGIC UNIT





**MIC**

**VCO**

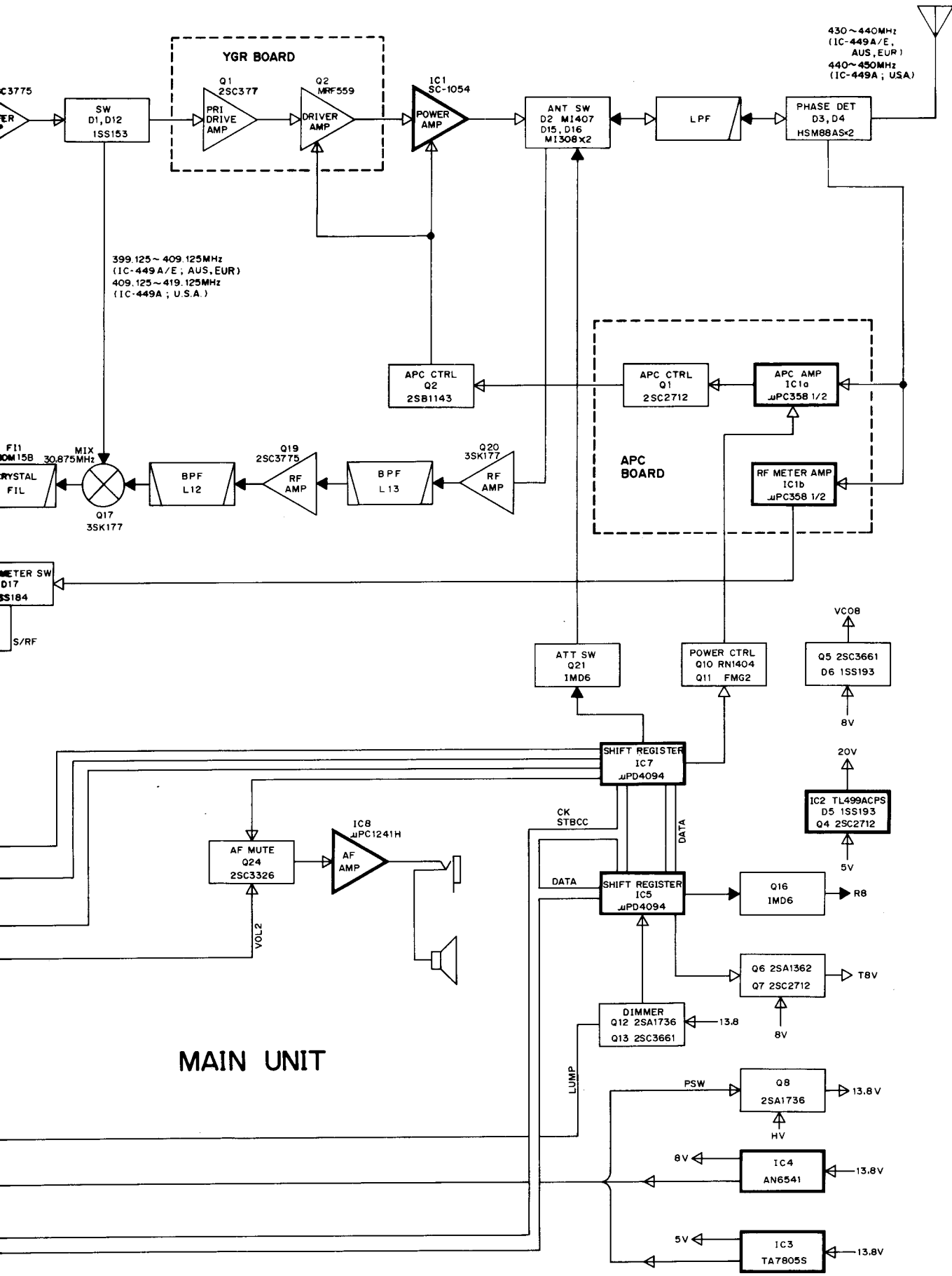
**PLL-A**

**IF**

399.12 (IC-4)  
409.12 (IC-4)

STBCC CK DATA





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