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**REALISTIC®**

# Service Manual

19-1140

## HTX-404

### 70 CM Amateur UHF-FM Transceiver

### Catalog Number: 19-1140

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448,275

# SPECIFICATIONS

## GENERAL

Frequency Range .....	440-450MHz
Frequency Step .....	5/10/15/20/25/50/100kHz
Frequency Stability .....	+/- 10ppm
Antenna Impedance .....	50 ohms unbalanced
Speaker .....	8 ohms
Microphone .....	Condenser Mic. 1.2 kohms
Channel Display .....	LCD 8 digits
Operating Temperature .....	14°F to 140°F (-10°C to 60°C)
Size .....	2×4×1 Inches (65×117×37mm)
Weight .....	1 lb 3 oz (550g)
Supply Voltage: Alkaline Battery Pack .....	9 VDC
Ni-Cad Battery Pack (600mAh) .....	7.2 VDC
External Power Jack .....	7.2 to 13.8 VDC

## RECEIVER

Intermediate Frequency	
1st IF .....	45 MHz
2nd IF .....	455 kHz
Sensitivity:	
12dB SINAD .....	0.2μV
20dB NQ .....	0.3μV
Squelch Sensitivity:	
Threshold .....	0.1μV
Tight .....	2.0μV
Spurious Response Attenuation .....	60 dB
Intermodulation Attenuation .....	60 dB
Adjacent Channel Rejection (25kHz) .....	54 dB
Modulation Acceptance Bandwidth .....	8 kHz
Hum and Noise .....	43 dB
Audio Output Power (10% THD):	
7.2V DC .....	0.3W
9V DC .....	0.5W
12V DC .....	1W
13.8V DC .....	1W
Audio Distortion .....	2%
Audio Response .....	-6dB/oct
Current Drain:	
Standby Without Power Save .....	43mA
Standby With Power Save .....	25mA
CTCSS Sensitivity .....	0.15μV

## TRANSMITTER

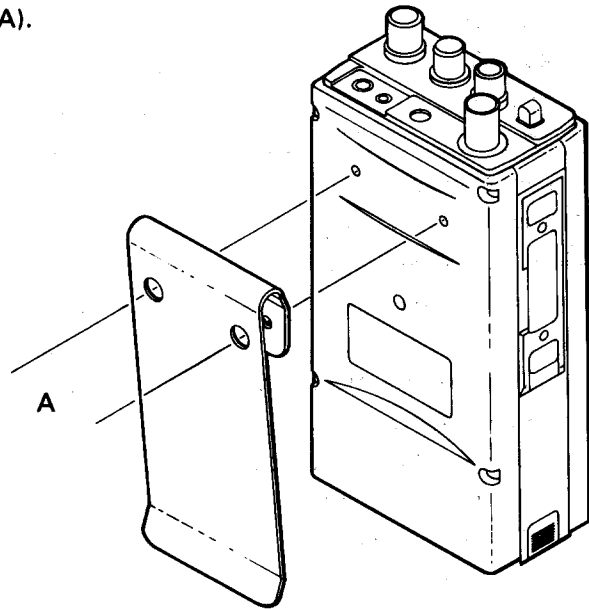
### RF Power Output:

7.2V DC .....	(W/STD. NICAD)	1.5W
9V DC .....		2.4W
12V DC .....		3.8W
13.8V DC .....		5W
Low Power .....		0.5W
Maximum Deviation .....		4.5kHz
Hum and Noise .....		40 dB
Audio Distortion .....		1.5%
Audio Response .....		+ 6dB/oct
Spurious and Harmonic Emissions .....		70 dB
Frequency Error .....		$\pm 0.0005\%$
Microphone Sensitivity.....		2mVrms
CTCSS Tone Deviation .....		0.7 kHz
DTMF Tone Deviation .....		3.5kHz
Current Drain:		
7.2V DC .....		0.6A
9V DC .....		1.2A
12V DC .....		1.8A
13.8V DC .....		2A
Lower Power .....		0.5A

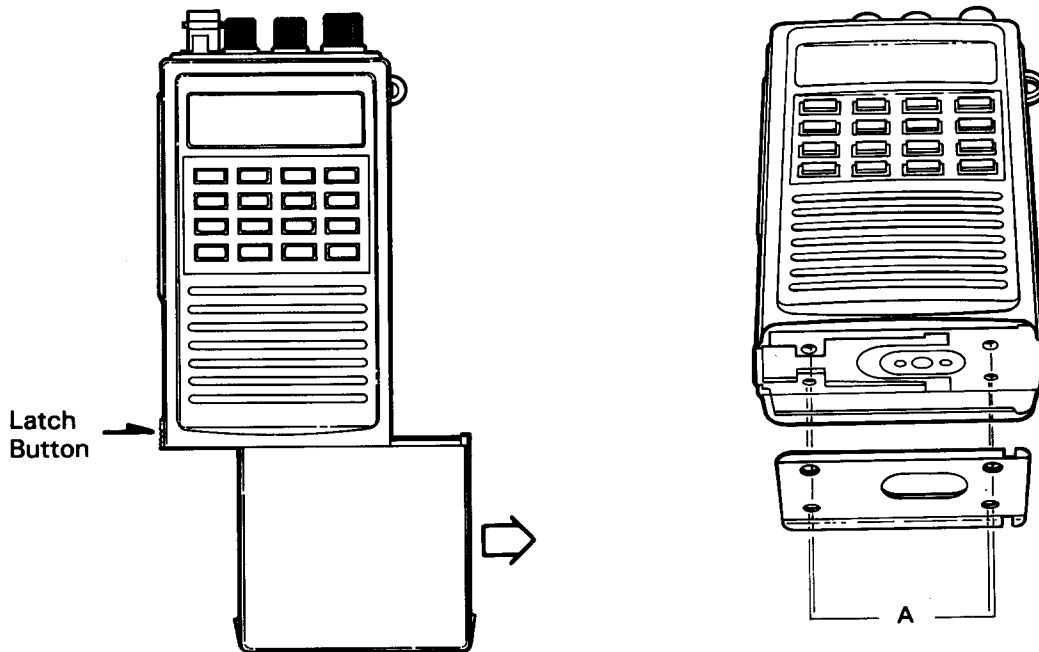
**Note:** Nominal specs represent the design specs. All units should be able to approximate these—some will exceed and some may drop slightly below these specs. Limit specs represent the absolute worst condition that still might be considered acceptable; in no case should a unit fail to meet limit specs.

# DISASSEMBLY INSTRUCTIONS

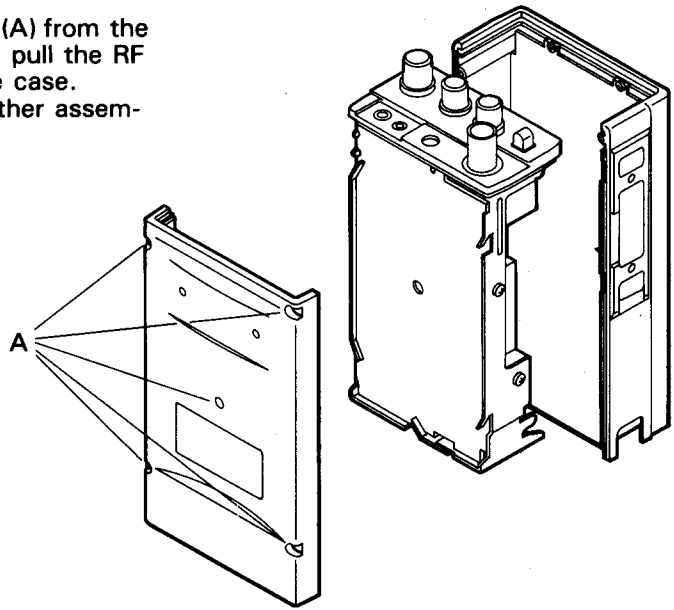
1. To remove the belt clip, remove two screws (A).



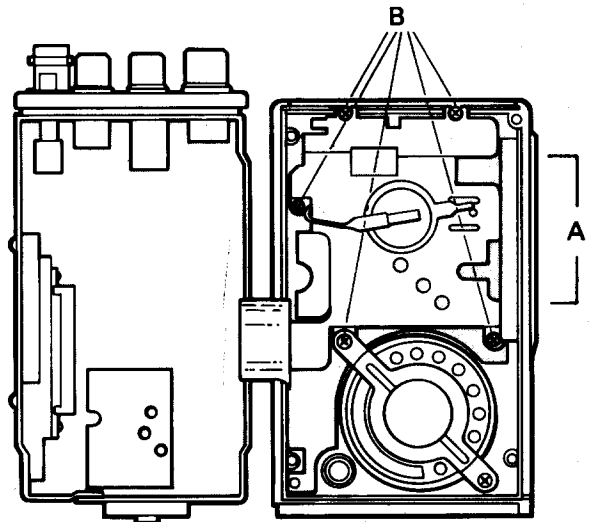
2. To remove the battery ground plate:
  - A. Remove the battery pack.
  - B. Remove four screws (A) from the battery ground plate.This also releases the latch mechanism.  
Note the position of the latch plate and the latch button.  
Then, remove the latch mechanism and button.



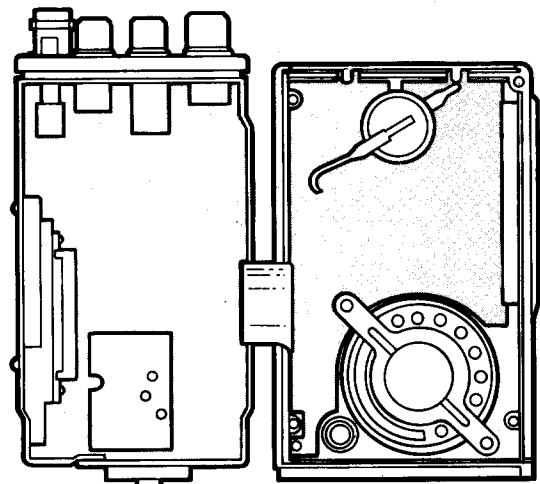
3. To access the RF board, remove five screws (A) from the back cover and lift off the back cover. Then pull the RF section out from the top and lift it out of the case. Be careful not to pull the ribbon trace from either assembly when you remove the RF section.



4. To access the digital board  
A. Remove two screws (A) from the PTT button.  
B. Then, remove five screws (B) from the shield plate.  
C. Desolder the lithium battery from the shield plate.  
D. Solder the lithium battery to ground on the RF board for testing.

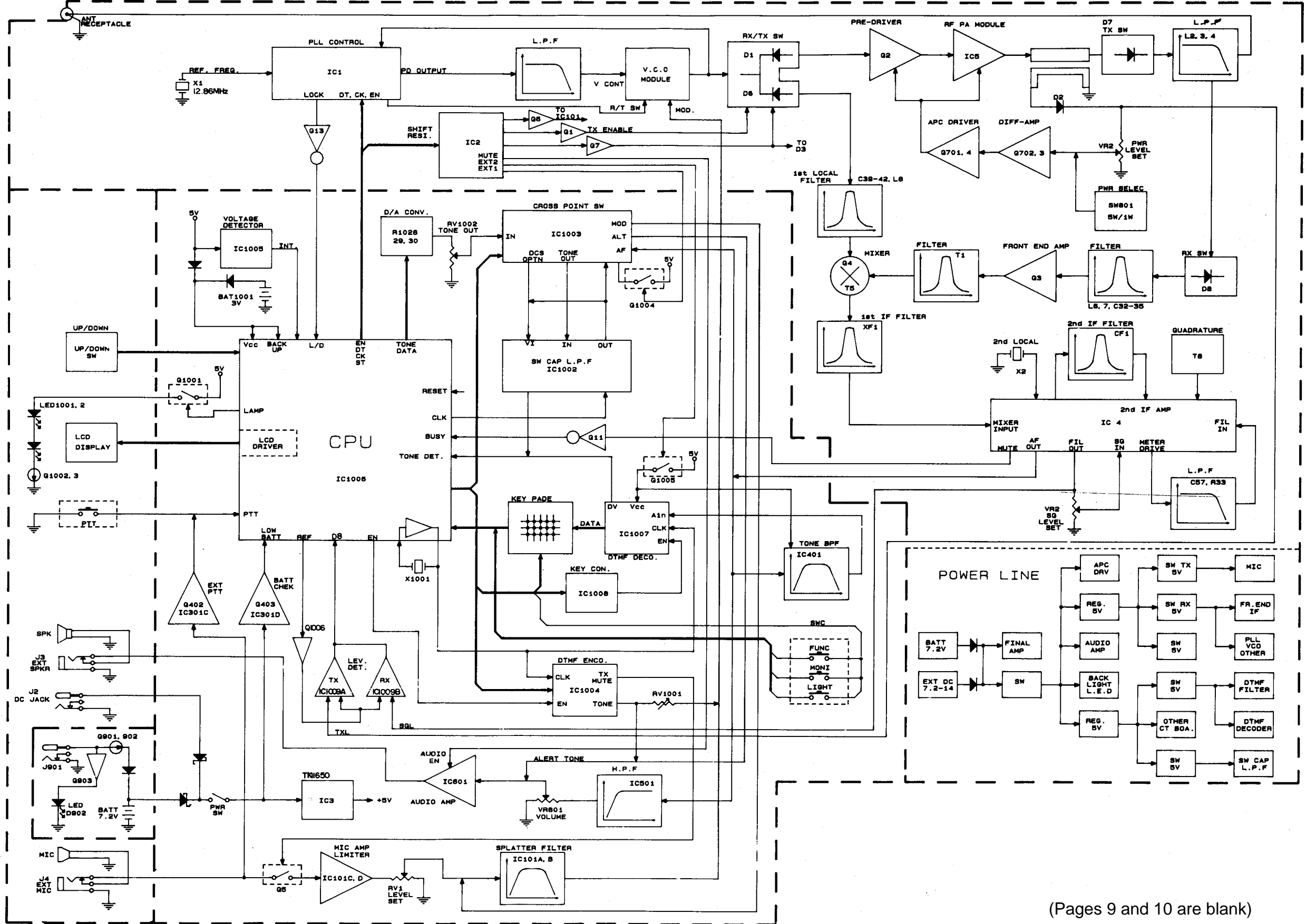


5. To reassemble, follow the disassembly steps in reverse order.



# BLOCK DIAGRAM

Cat. No.: 19-1140



(Pages 9 and 10 are blank)

# THEORY OF OPERATION

The 19-1140 radio is comprised of two main populated PCBs (an RF PCB and a control PCB). The RF PCB contains the transmitter and receiver circuits. The control PCB contains the microprocessor controller and associated digital circuits and the keypad PCB.

## TRANSMITTER

The transmitter is comprised of:

- Microphone audio circuit
- Transmitter stage and harmonic filter
- Automatic power control
- Frequency synthesizer circuit

### Microphone audio circuit

The audio signals from the microphone (via CON1001, pin 3) or the external microphone (via the MIC jack J4, flexible pin 2) are amplified, pre-emphasized, and limited by IC101 and associated components. The AF microphone signal is applied to the MIC module to produce an amplified and pre-emphasized audio signal. The signal is limited by IC101C/D and applied via VR1 to a low-pass filter (IC1-1A/B). The low-pass filter rejects frequencies above 3kHz (outside the voice spectrum). The filtered signal is applied to the VCO pin 7 (within the frequency synthesizer circuit). RV1 is used to adjust voice deviation.

### Transmitter stage and harmonic filter

The power amplifier contains the RF power module IC5. When in the transmit mode of operation, diodes D1 and D7 are forward biased, enabling the RF signal to pass to the input buffer Q2. The buffered RF signal is further amplified by the RF power module IC5. The amplified RF signal passes through the stripline coupler and is fed to the harmonic low-pass filter comprising L2 and C20, L3, L4, and then to the antenna connector (ANT).

The coupler provides a sample of the RF signal for the automatic power control.

### Automatic power control

The automatic power control is modulated as the combination of Q701 to Q704 and contains the stripline coupler, diode D2, variable resistor VR2, two comparators (Q703 and Q702) and transistors Q704 and Q701. The RF signal present in the coupler is rectified by D2 to produce a DC voltage that is passed to VR2. The DC voltage is also applied to Q703 pin 3 via VR2. The voltage TX 5V is applied to the base of Q702 via a potential divider. Q702 and Q703 determine the RF power level by producing a difference signal. The difference signal is passed to Q701 and Q704 to produce a constant power output to the antenna connector ANT. VR2 is used to adjust the RF power level.

### Frequency synthesizer circuit

With data received from the microprocessor (IC1006), the frequency synthesizer circuit controls and produces the RF carrier frequency for the transmitter during transmission and the local oscillator frequency for the receiver.

The frequency synthesizer circuit is comprised of:

- RX and TX voltage controlled oscillator module
- Loop filter
- PLL frequency synthesizer and prescaler chip

#### **RX and TX voltage controlled oscillator module**

A VCO module produces carrier frequencies during transmission and the local oscillator frequency during reception. The module also has a power line filter.

#### **RX and TX power line filter**

Transistor Q205 is configured as a 5V (module, pin 5) power supply ripple filter.

#### **RX VCO**

The RX VCO is comprised of a low noise transistor Q204, coil L204, and varactor D201 and D202 and is configured as a Colpitts oscillator. D201 and D202 produce a change in frequency with a change in DC voltage and are controlled by the phase detector signal (via module pin 6) present at the anode. The local oscillator signal at the drain of Q204 is applied to pin 1 of the module, when D1 is reverse biased and D6 is forward biased. L204 is used for PLL alignment.

#### **TX VCO**

When TX switching transistor Q203 is turned on by IC3 (via module pin 4), D203 is reverse biased and C202 is disconnected from the OSC tank circuit. Then, the frequency range is changed for TX. The AF signal at the MIC AMP module pin 6 is applied to the anode of D201, D202 via pin 7 of the module. The control voltage from the loop filter is applied to the cathode of D201, D202 (via module pin 6). The TX RF modulated signal produced at the drain of Q204 (module pin 1) is passed to the power amplifier and harmonic filter via the buffer amplifier (Q2), when diode D1 is forward biased and D6 is reverse biased.

#### **Loop filter**

Resistors R51 and capacitors C80 to C81 are the loop filter. The phase detector from IC1 pin 6 is filtered by R50, R52, R49, C75 to remove any reference frequency harmonics and then applied to the RX and TX voltage controlled oscillator module pin 6.

#### **PLL frequency synthesizer**

The PLL frequency synthesizer contains an oscillator for the reference crystal, a reference divider, a programmable divider, a phase/frequency comparator, an out-of-lock detector, an RX/TX switch, a power saving control switch, and a prescaler.

#### **Reference oscillator**

The reference oscillator of IC1 along with a 12.8MHz crystal X1, TC1, C76, C77 produces a 12.8MHz reference signal at IC1 pins 1 and 2.



### **Programmable dividers**

IC1 has two dividers—a data programmable divider and a programmable reference divider.

### **Phase detector**

The phase detector (pin 6) produces negative pulses when  $F_v < F_r$  and positive pulses when  $F_v > F_r$ . When  $F_v = F_r$  and the phase is the same, the phase detector presents a high impedance at pin 6. The signal at pin 6 is applied to the VCO via the loop filter.

### **Out-of-lock detector**

The out-of-lock detector produces a high logic level when  $F_r$  and  $F_v$  are in the same phase and frequency, or low logic level pulses when the loop is out lock at pin 2 of IC1. The signals at IC1 pin 2 are buffered by Q13 and then integrated by R45 and C78. The product of the integrating circuit is fed to flexible PCB 22.

### **Prescaler**

The internal prescaler divides the VCO frequency by 64 or 65.

## **RECEIVER**

The receiver uses dual-conversion superheterodyning techniques and is comprised of:

- RF amplifier
- First mixer and first IF amplifier
- Second mixer, second IF amplifier, and FM detector
- Receiver audio circuit
- Mute (squellch) circuit

### **RF amplifier**

The receiver RF amplifier contains tuned circuits L6 and L7 and RF transistor Q3. Helical resonator T1 is configured as a 2-pole bandpass filter. The RF signal passes through tuned circuits L6 and L7, RF amplifier Q3, and T1, enabling the RF signal at the operating frequency to pass to the first mixer.

### **First mixer and first IF amplifier**

Crystal filter XF1 and coil T5 make up the first IF filter. The VCO local oscillator signal is applied via bandpass filter, C39, C40, and L8. Mixer transistor Q4 produces a difference frequency of 21.4 MHz at the drain connection, from the filtered RF signal at the gate connection and the filtered VCO local oscillator signal at the source connection. The 45 MHz difference frequency is filtered by the 2-pole crystal filter XF1. The tuned circuit T5 and associated components are matched to the crystal filter to insure good passband response and sensitivity. The IF signal is filtered by XF1 and passed to the second mixer, second IF, and FM detector.

### **Second mixer, second IF, and FM detector**

A signal conversion FM receiver integrated chip, IC4, contains the second mixer, second IF, and FM detector functions. The second local oscillator frequency is determined by the crystal X2 connected to IC4 pin 1. The IF signal is received at IC4 pin 16. The second IF frequency of 455 kHz is produced when the difference frequency is applied to the mixer via pin 6. The output of the second mixer via pin 3 is applied to a 455kHz bandpass filter, CF1. The output of CF1 is passed to a high gain IF amplifier (limiter) in IC4 via pin 5. The amplified signal is coupled to the adjustable quadrature detector T8. Any detected signal is produced at IC4 pin 9 and applied to the receiver audio circuit.

### **Receiver audio circuit**

The receiver audio circuit is made up of an audio amplifiers, a high-pass filter module, and a de-emphasis circuit on the RX/TX PCB.

### **High-pass filter module**

CTCSS signals from the recovered audio signal are removed by the high-pass filter. The high-pass filter is an 8-pole active filter that is comprised of IC501 and associated components. The de-emphasis is provided by resistor R42 and capacitor C70. The de-emphasized audio signal at CON2, connection 6, is fed to the audio amplifier on the RX/TX PCB via the volume PCB VR801.

### **Audio amplifier module**

IC601 is the audio amplifier. The audio signal at CON2 pin 5 is passed to IC601 pin 3 via variable resistor VR801 (located on the front panel). The gain of the amplifier is set by resistor R603 and C602. The amplified audio signal at IC601 pin 5 is applied to the internal speaker SPKR by the flexible PCB (pin 5). The external speaker connection is via the connector JACK 3.

### **Mute (squelch) circuit**

The squelch circuit switches off the audio power amplifier in the absence of RF signals. The squelch circuit is comprised of an internal carrier detector, squelch control, and VR802.

### **Internal detector circuit**

The carrier signal is detected by IC4 pin 13 and regulated by C57 and R33, and then DC amplified by the internal amplifier circuit via IC4 pin 10. The amplified signal is applied to IC4 pin 12 via SQ VR802 and then converted to logic level by the internal comparator of IC4. The output level is buffered and reverse phased by Q11 and is applied as the busy signal to the microprocessor by flexible PCB pin 10.

## **MICROPROCESSOR CONTROLLER**

The default of all functions in the radio is preset by the internal programmed microprocessor, and any other user's options including the frequencies of receive and transmit, are available by the microprocessor and its associated interfacing circuit.

### **Microprocessor**

The microprocessor is a high-speed Hitachi HD404818 8K-byte ROM with 4-bit access. It contains the LCD driver, I/O controller and voltage comparator. When the radio turns on, the microprocessor is power-on reset by C1021 of pin 78 to operate in the preset order in the masked ROM. When the radio turns off the data in RAM ins stored by the backup battery with about 2 $\mu$ A current from BAT1001 to pin 13.

### **POWER SWITCHING CIRCUIT**

When the PTT switch is pressed, the enable and clock data is forwarded by the microprocessor to IC1 pins 5, 6, 7, and to IC2 pins 1, 2, 3. When IC2 receives the enable and clock data, it holds pin 2 low, causing Q1 to turn on, and holds pin 14 high, causing Q7 to turn off. It reverses this in receive mode.

### **CTCSS/DTMF ENCODE AND DECODE CIRCUIT**

#### **CTCSS receive**

The detected audio signal is applied to IC1003 pin 11 for being switched out to pin 12, and then applied to IC1002 pin 8 to compare with OP AMP and passed to pin 3 to be applied to pin 13 through C1005 and R1005. It is further amplified and referenced by OP AMP to be passed to IC1003 pin 14. Again by the same procedure it is forwarded in to pin 1 and out to pin 2 to apply to the microprocessor pin 31 for the microprocessor control.

#### **CTCSS transmit**

The data received from the microprocessor pins 17, 18, and 19 are applied to IC1003 pin 10 via R1028, R1029, R1030, and RV1002 for being switched at OC1003. The signal received at IC1002 pin 8 via pin 12 is filtered to pass to pin 3 and then to pin 14 for being switched to transmit by flexible PCB pin 26 via pin 25.

#### **DTMF decoding circuit**

The audio detection output supplied to the Control Board is also applied to the bandpass filter pin 5 and passed to the DTMF Decoding IC (IC1007, pin 8) through the 8th active filter. With a data received from IC1008 it is forwarded to pin 14 to apply to the microprocessor pin 31 for the microprocessor control.

#### **DTMF encoding circuit**

When transmit DTMF is selected, the microprocessor pins 21, 22, 23, and 24 and out the data which is forwarded into IC1004. The cross point switching IC (IC1003) makes the switched data forward to IC1004 pin 14 to transmit the DTMF signal through flexible PCB pin 26 via RV1001, C1025 and R1038.

## **CONTROL AND INDICATOR CIRCUIT**

### **External PTT control circuit**

When the external microphone is connected at the MIC jack on the front panel, the internal microphone is disabled and converted to the external microphone by the MIC AMP jack, which is applied to the VCO via C61 and also applied to the level PCB pin 1, to output the level PCB pin 2. Then the microprocessor pin 11, being pulled as logic high via R1036, becomes logic low to enable it to operate like the internal PTT circuit.

### **Channel select circuit**

The channel switch encodes the channel number selected into a binary word. The binary word is passed through the RF flexible PCB and the top panel PCB to the microprocessor pins 12 and 13 for the microprocessor control.

### **Squelch level indicator**

The received signal is applied to IC4 pin 11 to compare with the reference squelch level via R32 and is passed to the level PCB pin 8 for input to the microprocessor. The microprocessor then indicates the squelch level on the display.

### **TX level indicator**

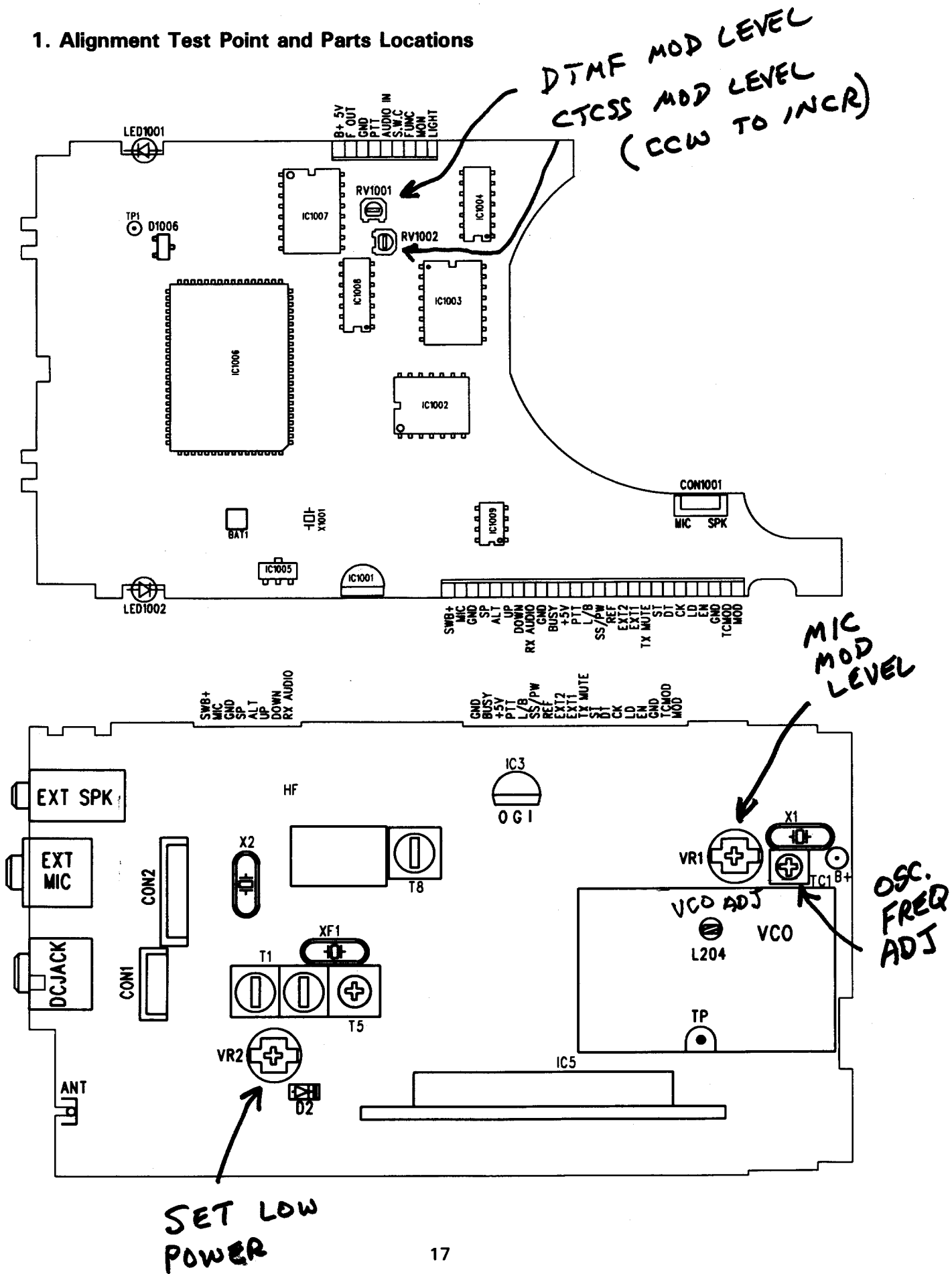
The transmitted signal is applied to the level PCB IC301 B via direction couplers D2, RV3, and R31 to compare with the reference TX level and is then passed to the level PCB pin 8 for input to the microprocessor. The microprocessor then indicates the TX level on the display.

### **Battery low indicator circuit**

In case the battery voltage drops below approximately 6V (it may depend on the voltage of the battery or power supply), the voltage comparator is applied to the level PCB pin 4 via R308 to compare with the reference (IC301 pin 10) and is then passed to the level PCB pin 3. The microprocessor then indicates BATT LOW on the display so the user will know that the battery must be replaced or recharged.

# ALIGNMENT INSTRUCTIONS

## 1. Alignment Test Point and Parts Locations



## 2. Phase Locked Loop and CPU Section

### A. Test Equipment Required

- a. Frequency counter
- b. DC power supply
- c. DC voltmeter (input impedance 10 ohms)
- d. RF attenuator (20dB, impedance 50 ohms)

### B. Alignment Procedure

Step	Setting	Connection	Adjust	Adjust for
1	RX VCO voltage adjustment Frequency: 450.000 MHz MIC: Receive Function: None Volume: Optional Squelch: Optional	DC voltmeter to VCO pin 6 (Figure 1)	L204	4.2-4.6V DC
2	TX VCO voltage adjustment Frequency: 450,000 MHz MIC: Transmit (unmodulated) Function: None Volume: Optional Squelch: Optional	DC voltmeter to VCO pin 6 (Figure 1)	L204	4.1 ~ 4.3V DC
3	Frequency adjustment Frequency: 446,000 MHz MIC: Transmit (unmodulated) Function: None Volume: Optional Squelch: Optional	Antenna to frequency counter, through attenuator (Figure 2)	TC1	3.9V DC (3.7-4.1V DC) and 3.5V DC (3.3 ~ 3.7V DC)

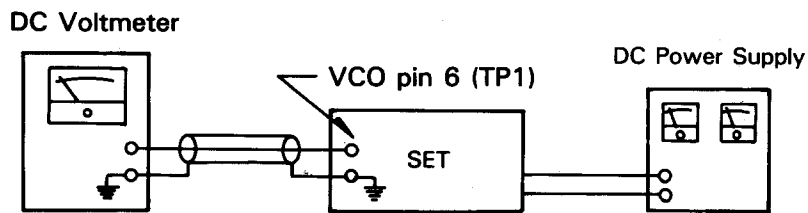


Figure 1

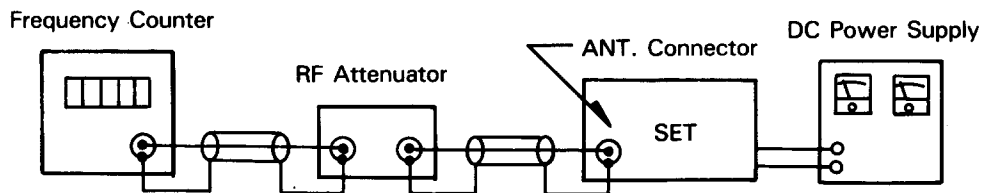


Figure 2

### 3. Transmitter Section

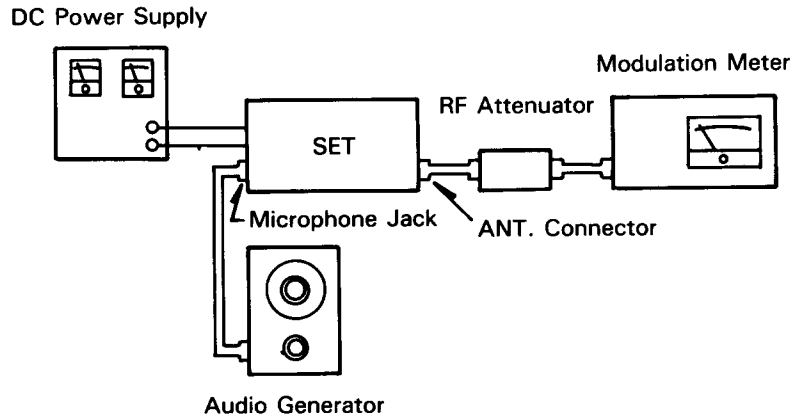
#### A. Test Equipment Required

- a. RF power meter (RF SSVM)
- b. 50 ohm dummy load (non-inductive)
- c. RF attenuator (50 ohms: non-inductive)
- d. Oscilloscope
- e. Audio generator
- f. DC power supply
- g. Spectrum analyzer
- h. Frequency counter
- i. Coupler
- j. Modulation meter (FM)

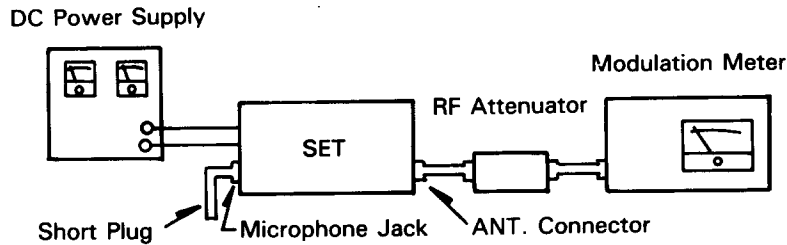
#### B. Alignment Procedure

Step	Setting	Connection	Adjust	Adjust for
1	AF modulation adjustment Frequency: 446.000MHz MIC: Transmit Function: None Volume: Optional Squelch: Optional RF Power selection : High	Connect the audio generator (set to 1KHz) to the microphone jack. Connect the modulation meter through the RF attenuator to the ANT jack. Adjust the audio signal level to obtain 3kHz deviation. When you increase the audio signal by 20dB, the deviation should not exceed 5kHz deviation. (Figure 3)	RV1 <b>VR1</b>	3.8kHz (3.5 ~ 4K)
2	CTCSS modulation adjustment Frequency: 446.000MHz MIC: Transmit Function: Tone squelch mode (CTCSS: 100Hz) Volume: Optional Squelch: Optional RF power selection: High	Connect the short plug to the microphone jack. Connect the modulation meter through the RF attenuator. Connect the RF power meter to the EXT-ANT jack on the set. (Figure 4)	RV1002	0.7kHz (500 ~ 1kHz)
3	DTMF modulation adjustment Frequency: 446.000MHz MIC: Transmit Function: DTMF squelch mode Volume: Optional Squelch: Optional RF power selection: High	Connect the short plug to the microphone jack. Connect the modulation meter through the RF attenuator to the EXT-ANT jack on the set. Press a number button on the set. (Figure 4)	RV1001	3.5kHz (3.3 ~ 3.8K)

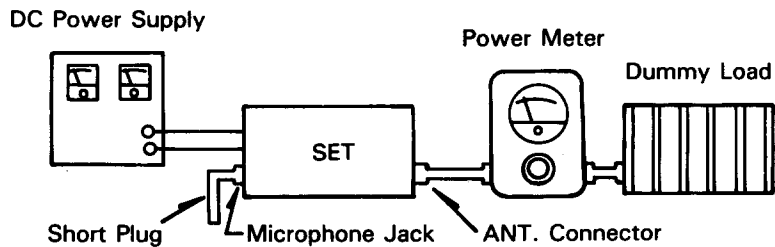
4	Low power adjustment Frequency: 446,000MHz MIC: Transmit Function: None Volume: Optional Squelch: Optional RF power selection: Low	Connect the short plug to the microphone jack. Connect the dummy load to the EXT-ANT jack on the set through the RF power meter. (Figure 5)	RV2 <i>VR2</i>	0.5W (0.3~0.7W)
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(Figure 3)



(Figure 4)



(Figure 5)



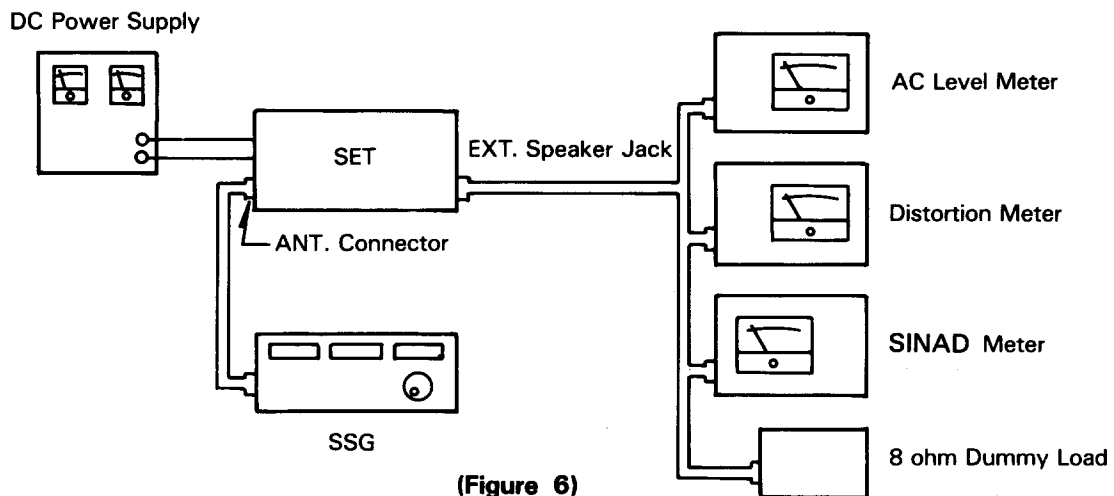
## 4. Receiver Section

### A. Test Equipment Required

- a. Standard signal generator (SSG)
- b. AC level meter
- c. Distortion meter
- d. DC power supply
- e. 12dB SINAD meter

### B. Alignment Procedure A

Step	Setting	Connection	Adjust	Adjust for
1	<p>RX sensitivity adjustment</p> <p>Frequency: 440MHz-450MHz</p> <p>MIC: Receive</p> <p>Function: None</p> <p>Volume: Adjust for 1V on the level meter</p> <p>Squelch: Turn fully counterclockwise</p> <p>SSG: Audio 1kHz Modulation 3kHz</p>	<p>Connect the standard signal generator to the EXT-ANT jack.</p> <p>Connect the AC volt level meter, distortion meter, and SINAD meter across the EXT speaker jack with an 8 ohm dummy load. (Figure 6)</p>	<p>T8</p> <p>T1</p>	<p>Maximum indication on AC level meter.</p> <p>Maximum sensitivity indication on 12dB SINAD meter.</p> <p>In the above condition, sensitivity is flat for 440-450MHz</p>
2	<p>Distortion adjustment</p> <p>Frequency: 446.100MHz</p> <p>MIC: Receive</p> <p>Function: None</p> <p>Volume: Adjust for 1V on the AC level meter</p> <p>Squelch: Turn fully counterclockwise</p> <p>SSG: Audio 1kHz Modulation 3kHz</p>	<p>Connect the standard signal generator to the EXT-ANT jack.</p> <p>Connect the AC volt level meter and distortion meter across the EXT speaker jack with an 8 ohm dummy load. (Figure 6)</p>	T5	Minimum indication on distortion meter.



# TROUBLESHOOTING HINTS

Symptom	Probable Cause	Remedy
Unit does not work at all	<ol style="list-style-type: none"> <li>1. Defective power switch VR801</li> <li>2. Defective diode D4, D5</li> <li>3. Broken DC power cord</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace</li> <li>2. Replace defective component(s)</li> <li>3. Replace</li> </ol>
No output from speaker at all	<ol style="list-style-type: none"> <li>1. Defective external speaker jack</li> <li>2. Poor connection on microphone connector</li> <li>3. Measure all the voltage of sub board on the audio PCB</li> <li>4. Defective internal speaker</li> </ol>	<ol style="list-style-type: none"> <li>1. Repair or replace</li> <li>2. Repair or replace</li> <li>3. Repair or replace</li> <li>4. Replace</li> </ol>
No noise on speaker	<ol style="list-style-type: none"> <li>1. Measure all the voltages of audio PCB</li> <li>2. Defective squelch circuit components (VR802, C57, C58, R28, R29, R30, R33, R34, R36, R1022, Q11, IC1006 pin 9) Compare with the voltage chart</li> </ol>	<ol style="list-style-type: none"> <li>1. Repair or replace</li> <li>2. Replace defective component(s)</li> </ol>
Squelch does not work	<p>Defective squelch circuit components (VR802, C57, C58, R28, R29, R30, R33, R34, R36, R1022, Q11, IC1006 pin 9) Compare with the voltage chart</p>	Replace defective component(s)
No modulation	<ol style="list-style-type: none"> <li>1. Defective microphone</li> <li>2. Measure all the voltages of sub board on the MIC PCB</li> <li>3. Defective TX mute circuit components (Q5, R3 pin 8 of IC1004) Compare with the voltage chart</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace</li> <li>2. Replace</li> <li>3. Replace defective component(s)</li> </ol>
LCD does not work	Measure all the voltages of IC1005, D1001, X1001 (IC1006 pin 77)	Replace defective component(s)
Back light does not work	Defective components of LED1001, LED1002, Q1001, Q1002, Q1003	Replace

# ERROR DISPLAY

## 1. Internal RAM Error: Er1

Er1 indicates an internal RAM error. It appears when the memory backup battery is dead or when something else has caused the memory contents to become corrupt. To clear the error, turn on the unit while pressing and holding the function button and D. This clears the memory.

If the error returns after you disconnect power, check the following components:

- Lithium battery
- Dual-diode RB417E (D1002)
- Cold solder joints

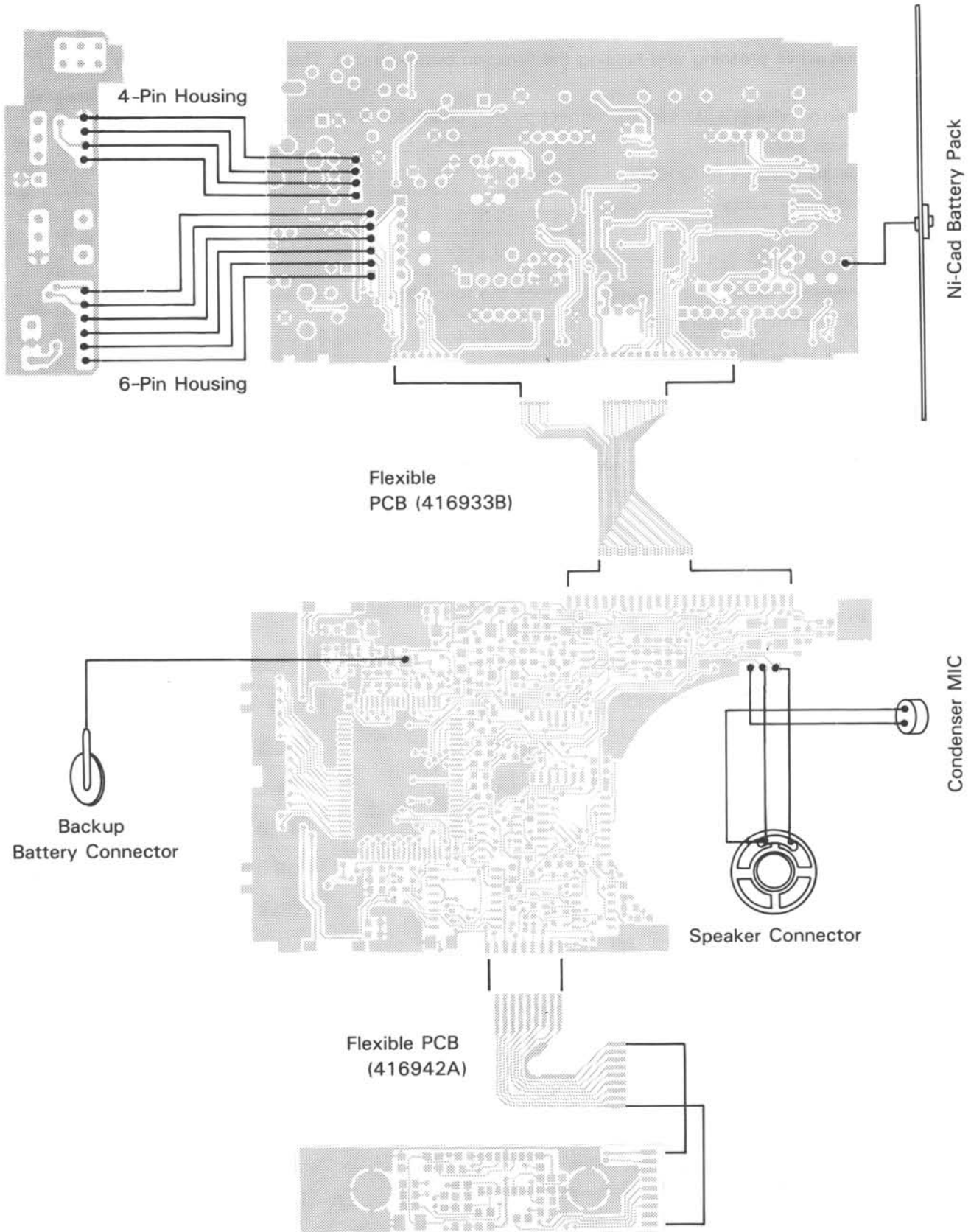
## 2. PLL Unlock Error: Er2

Er2 indicates the PLL has unlocked. Check the following:

- PLL alignment (from Page 18)
- 5V at Q12, Q13 and VCO pin 7
- Confirm that X1 is oscillating. If not, check the connections to IC1 pins 1 and 2.  
If the connection is good, check for 5 V at IC1 pin 5. If 5V is not present, check connections to pin 5 and power.
- Confirm that there is a 5kHz signal at IC1 pin 2. If it is not there, check connections to pin 19 (DT), pin 17 (EN), and pin 18 (CK).
- See if Q13 is normal.

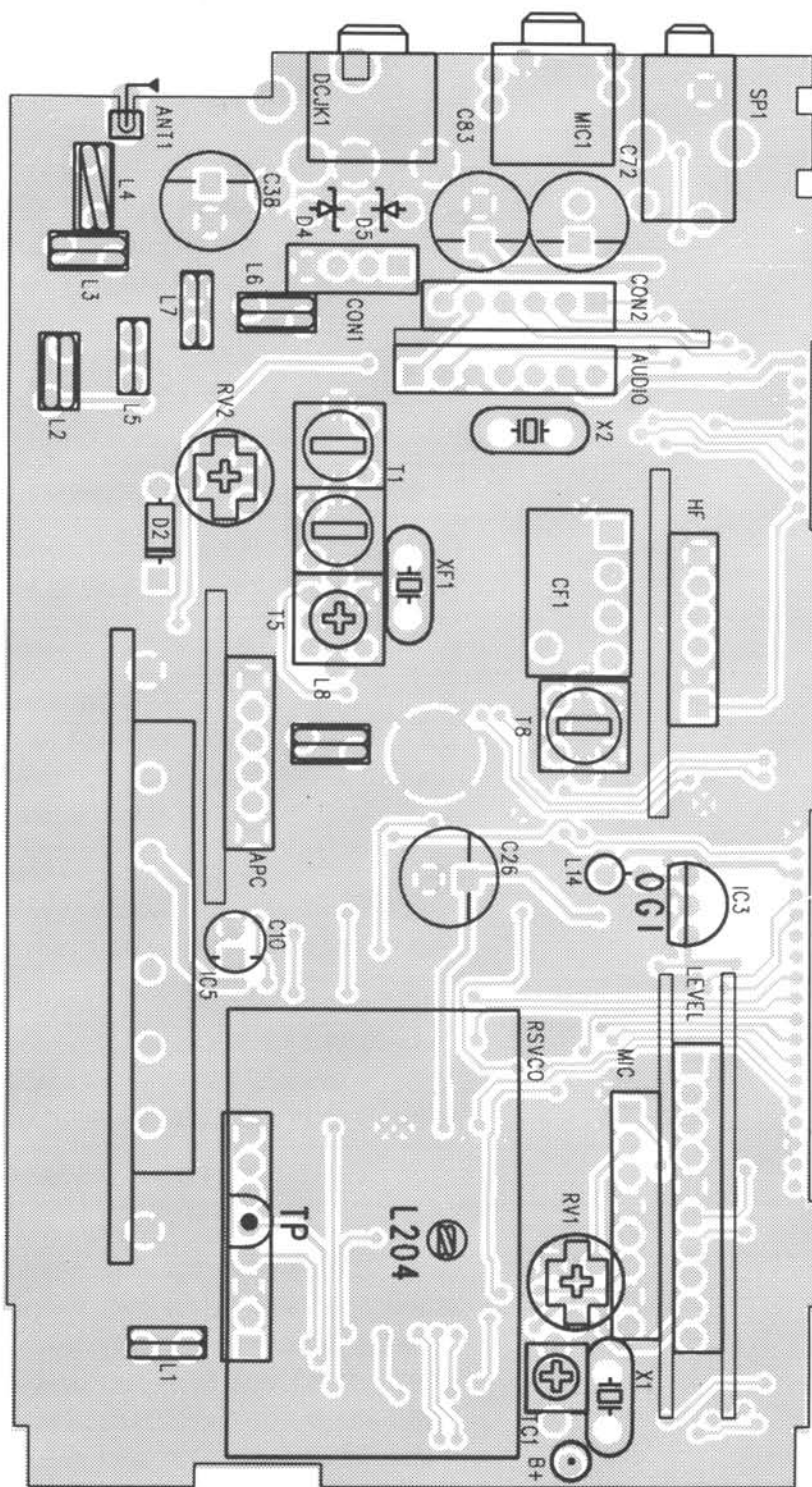
If the error message does not go away, replace IC1.

# WIRING DIAGRAM

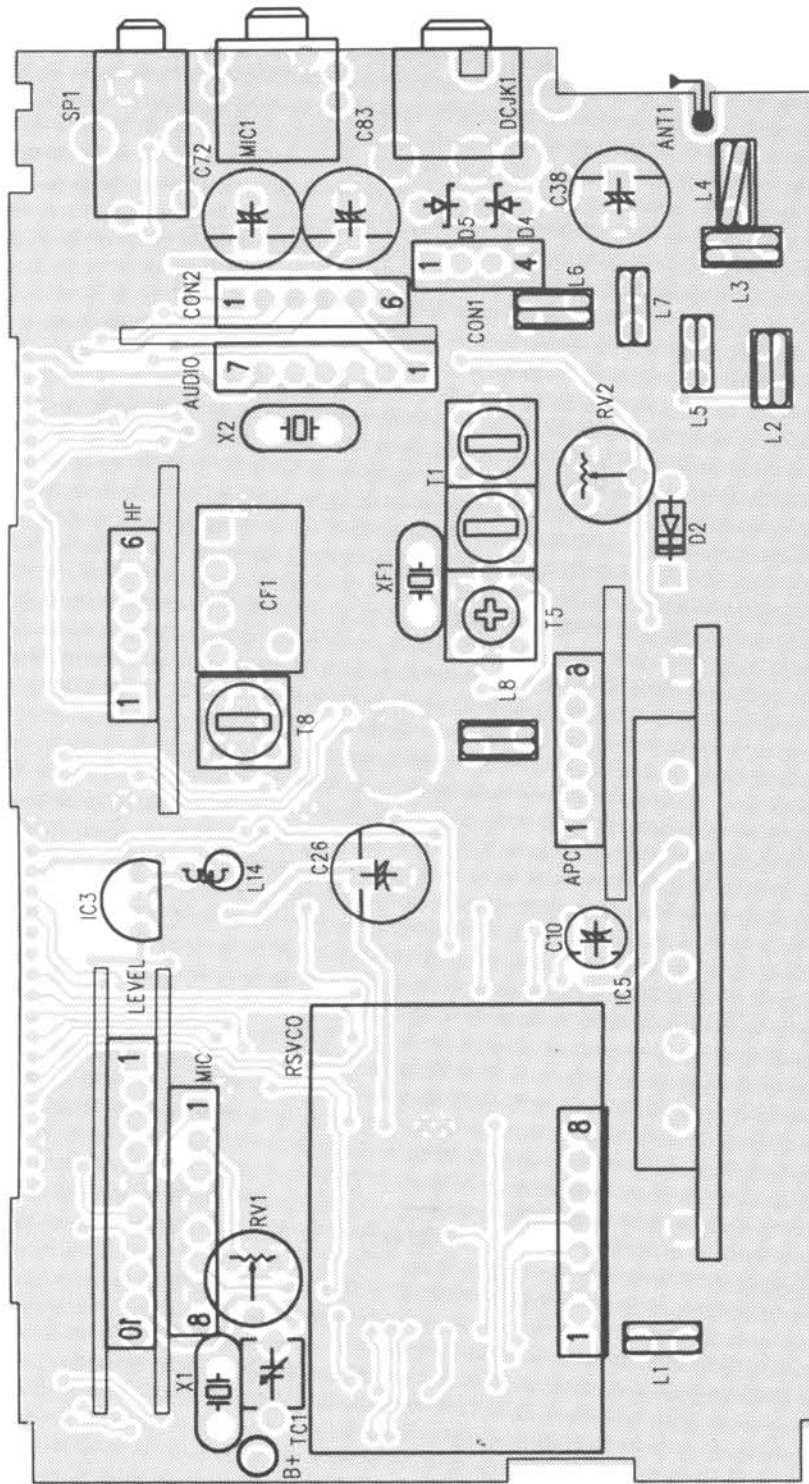


# PRINTED CIRCUIT BOARDS

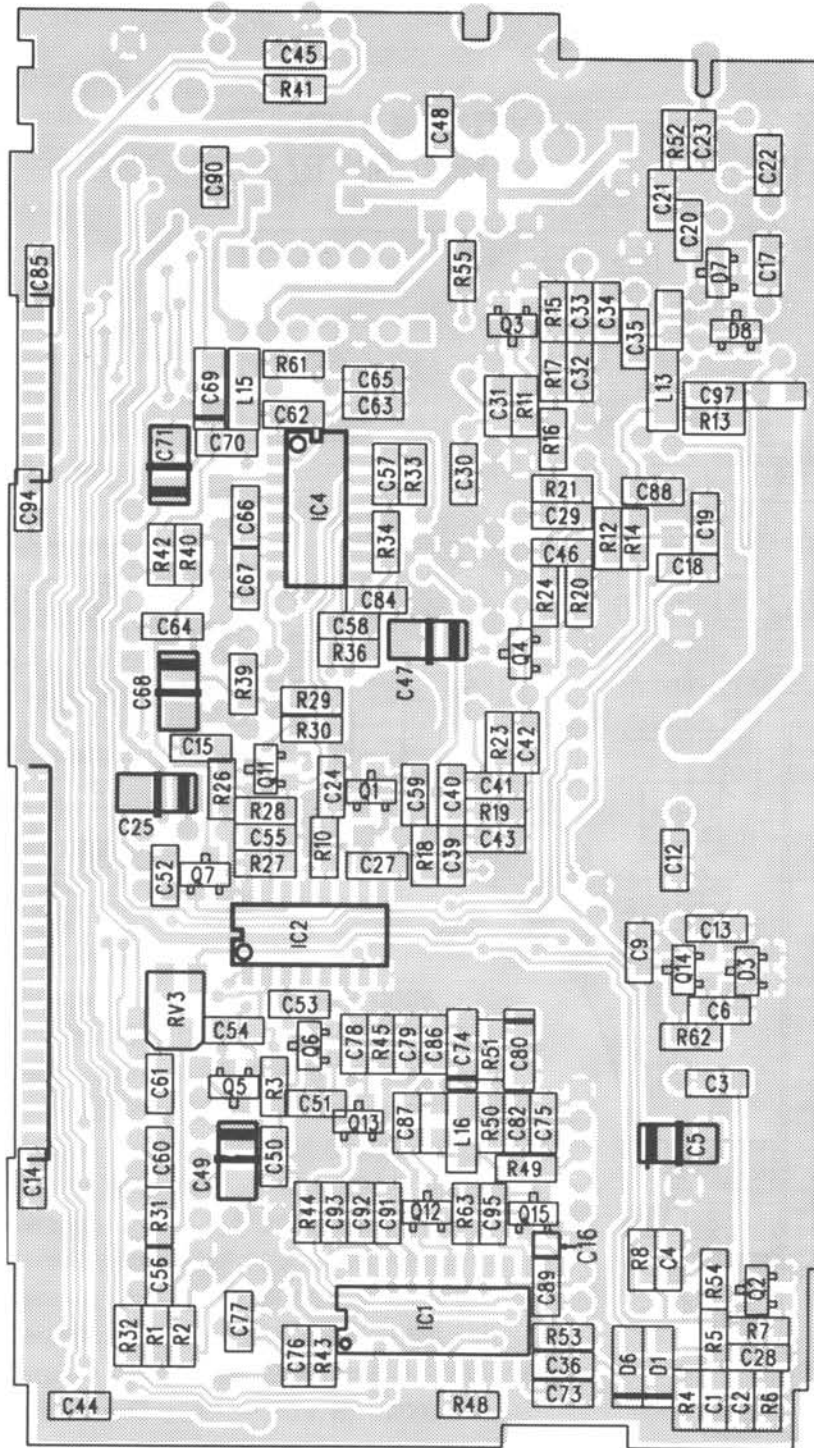
RF PCB: Top View



RF PCB: Bottom View

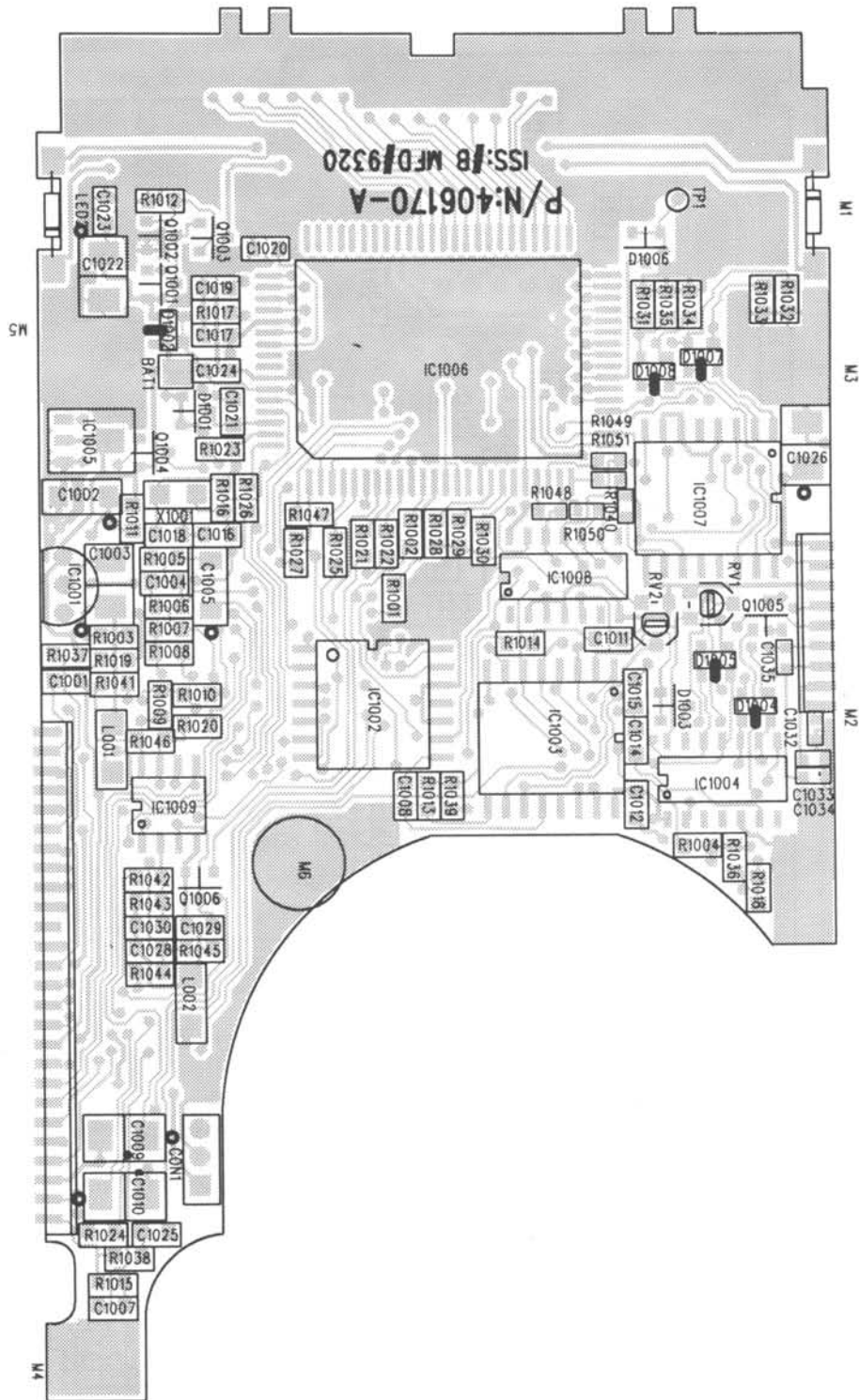


# RF PCB: Chip Component Side View



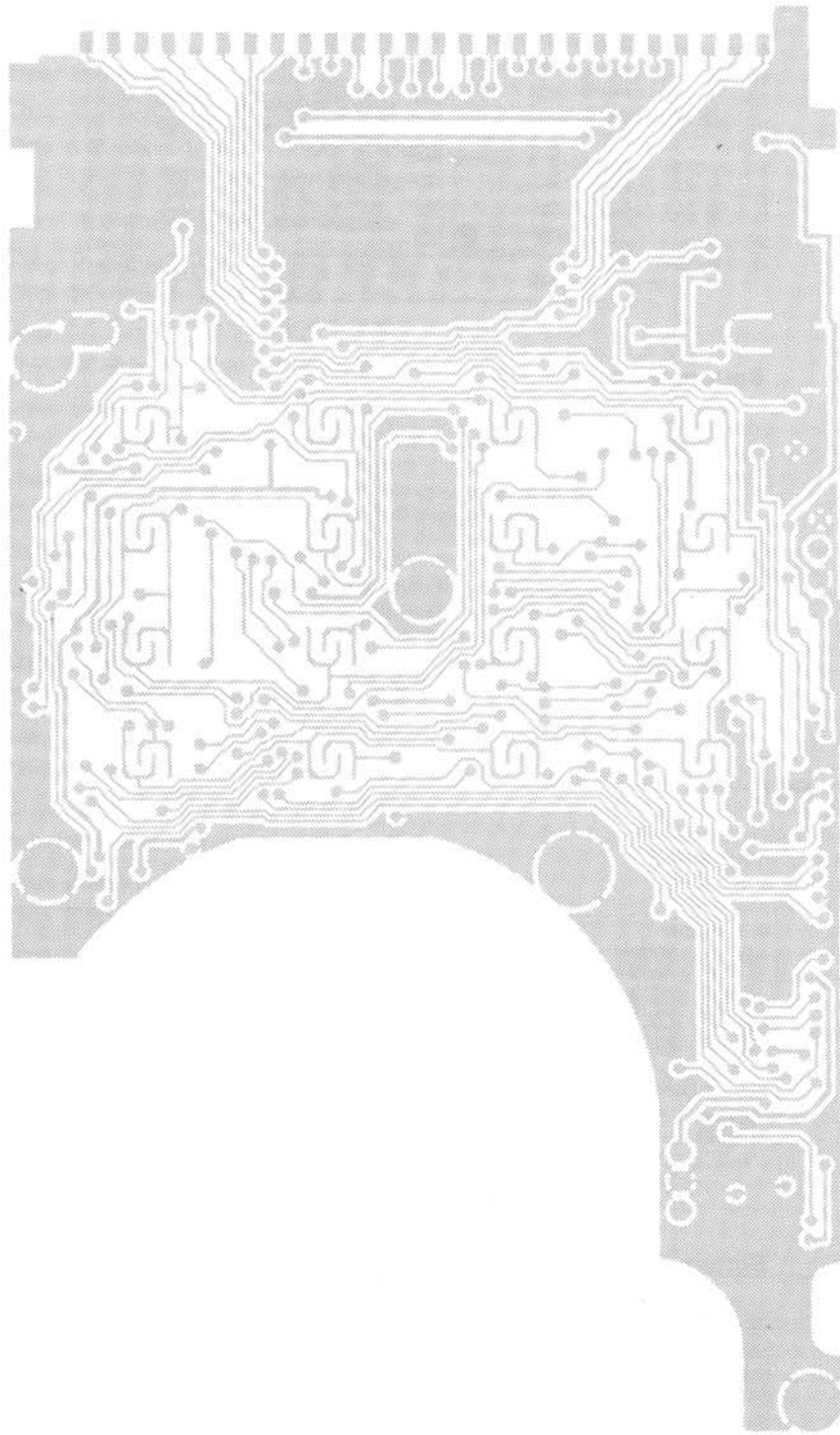


# Digital PCB: Keypad Side View (Top View)



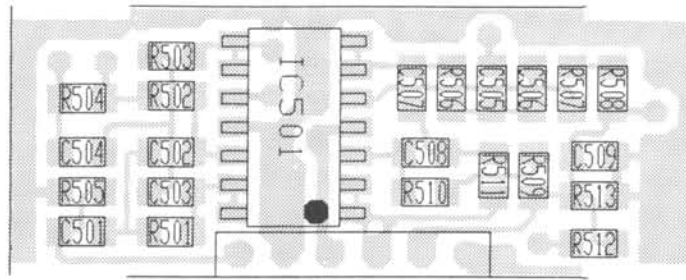


**Digital PCB: Keypad Side View (Bottom View)**

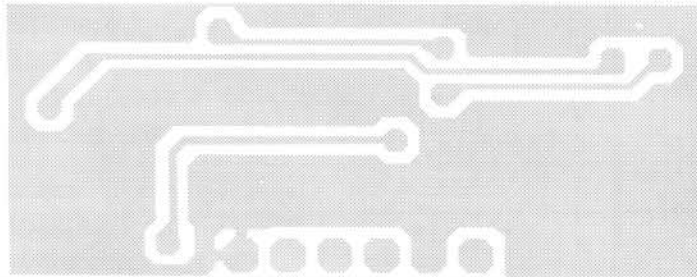


## High Press Filter PCB:

Top View

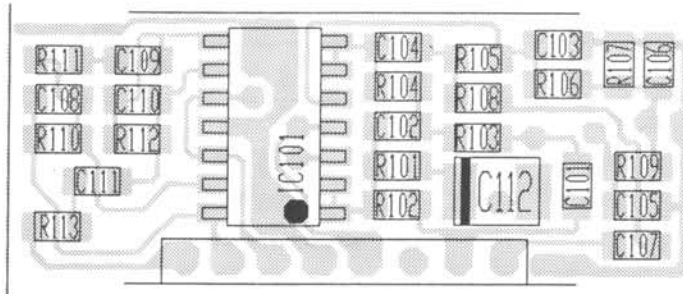


Bottom View

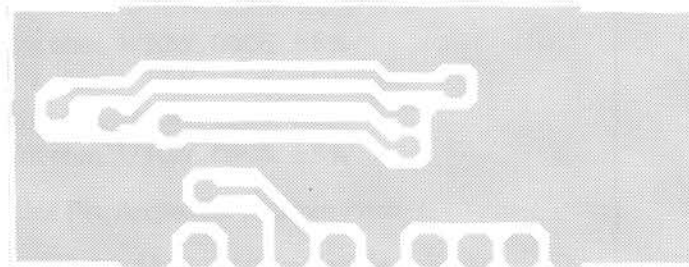


## MIC PCB:

Top View

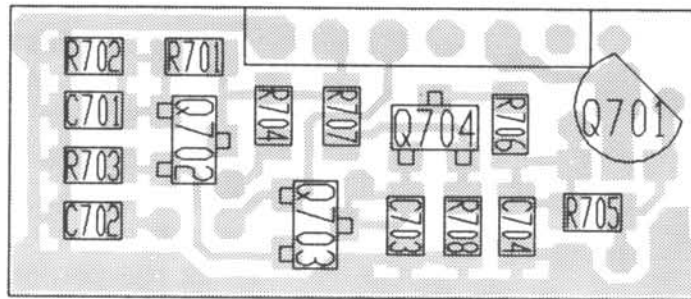


Bottom View

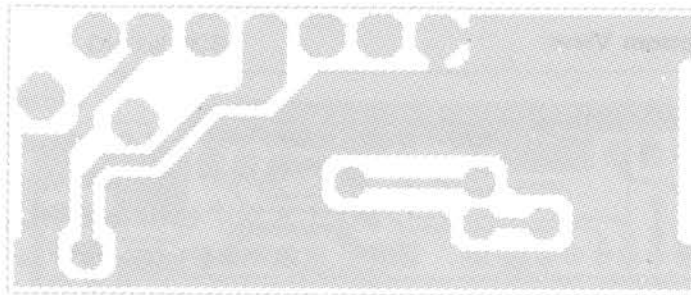


## Auto Power Control PCB:

Top View

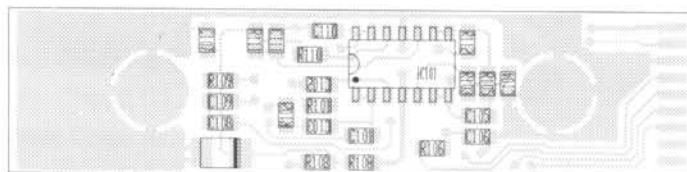


Bottom View

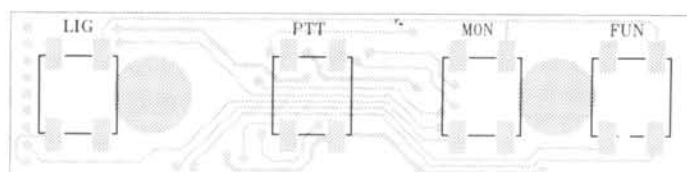


## PTT PCB:

Top View

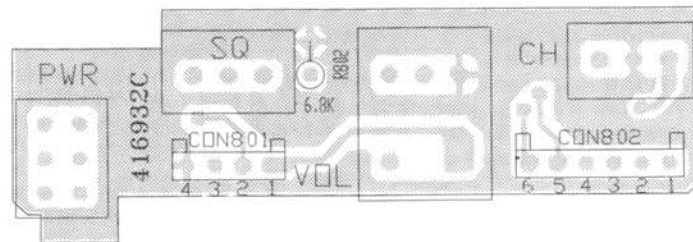


Bottom View

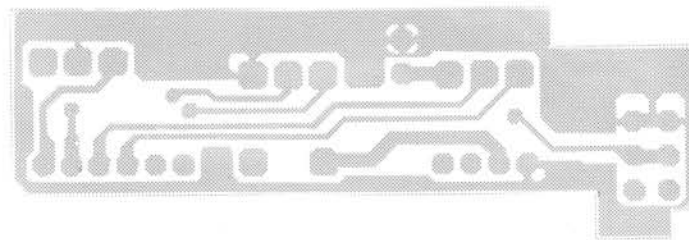


# Top PCB:

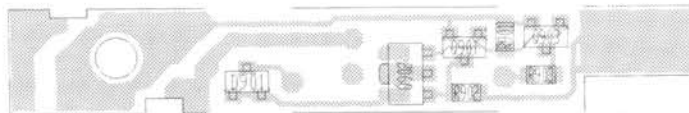
## Top View



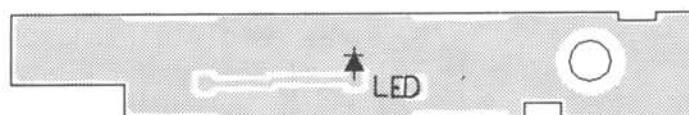
## Bottom View



## Top View

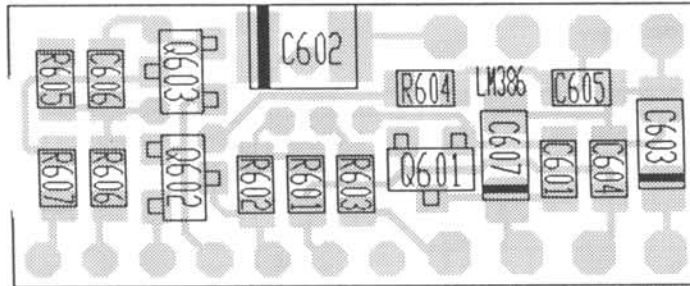


## Bottom View

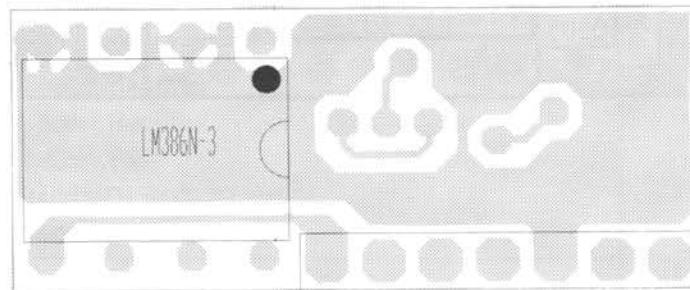


# Audio PCB:

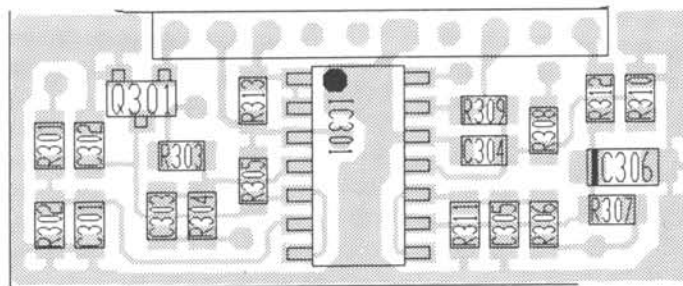
## Top View



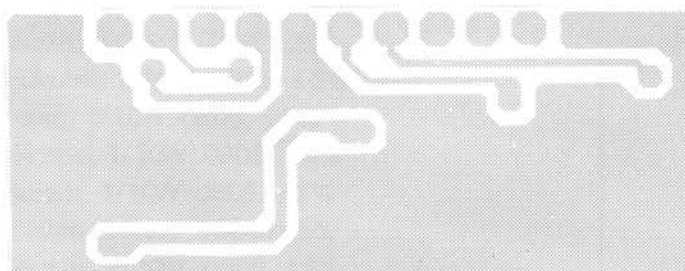
## Bottom View



## Top View

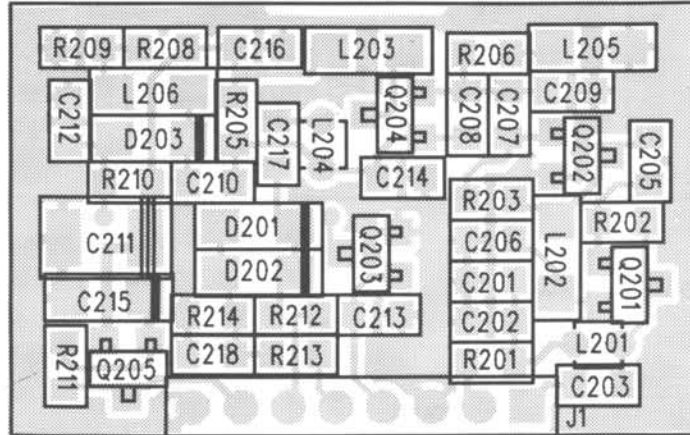


## Bottom View

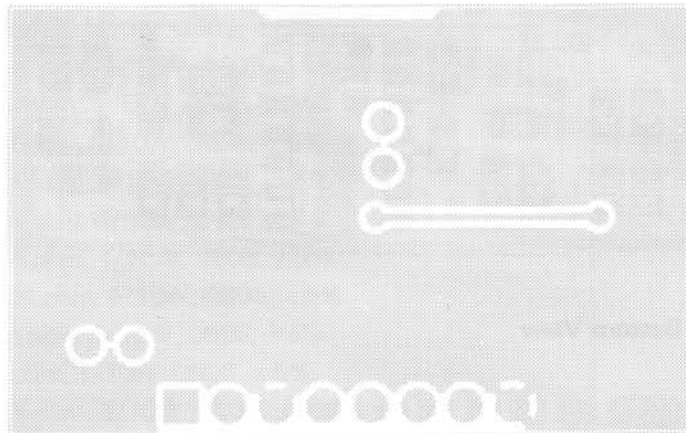


# VCO PCB:

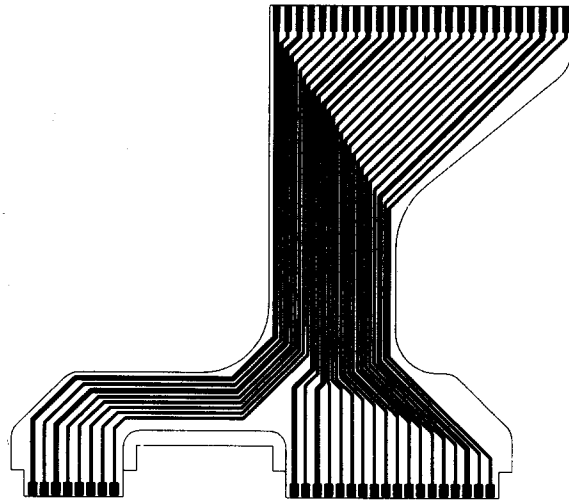
## Top View



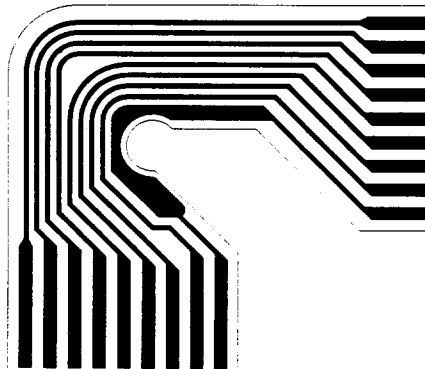
## Bottom View



**Flexible PCB (RF VS DIGITAL)**

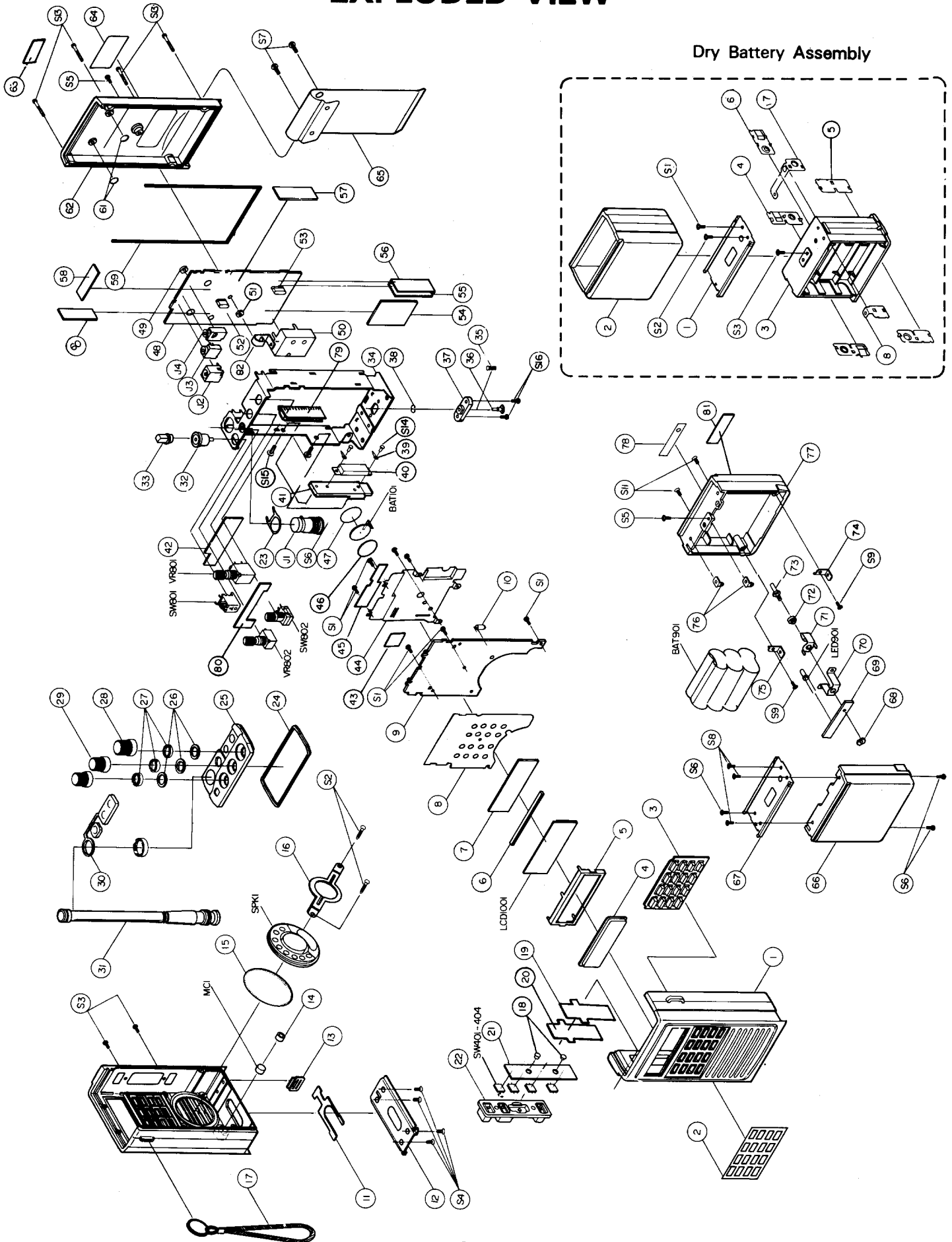


**Flexible PCB (PTT VS DIGITAL)**



# EXPLODED VIEW

## Dry Battery Assembly





## EXPLODED VIEW PARTS LIST

Ref. No.	Description	RS Part No.	Mfr's Part No.
1	Cover, Upper Lexan 141 70022		718-358-C
2	Overlay (KEY), PVC, 51 × 33.5 × 0.5t, Black		795-176
3	Pad Key, Silicon Rubber, 52.5 × 32 × 6.4, Gray		894-641-A
4	Lens acrylic, 60 × 17 × 2.6t, Clear		813-765
5	Holder LCD, SPTE 52.6 × 20.7, White		732-752
6	Zebra, LCD, YS-0.18, 52 × 2.6 × 1.9		422-390-2
7	Plate Illuminator, acryl, 52 × 17, Clear/White Silk Screen		795-177
8	Sticker, Silver Paper, 70 × 52, Silver		906-355-A
9	Assembly, Digital PCB		593-315
	Digital PCB		406-170
10	Holder Rubber, Silicon, D4 × 9.5, Gray		894-772
11	Stopper, 41.6 × 18 × t0.8 Natural		752-544-A
12	Plate Guide, 57 × 24.5 × 0.8t, Natural		771-934-A
13	Latch, PC, 10.8 × 13 × 3, Black		825-755
14	Bushing Mic, NBR Rubber, D7 × 5, Black		850-924
15	Filter Speaker, Felt, D36.5 × 0.1t, Black		906-336
16	Holder Speaker, SPC, D24.5 × 48 × 0.8t, Ni-Plating, White		723-702
17	Strap Carrying with Ring, 200mm, Black		906-337
18	Bushing, BsBM, D4 × 4.4, Sn-Plating, White		852-979
19	Shield Plate 38.5 × 27 × 0.2t White		772-117
20	Insulator 40.5 × 28 × 0.2t Clear		906-441
21	Assembly, PTT PCB		593-166
	PTT PCB		416-930-C
22	Pad PTT, Silicon Rubber, 57 × 14 × 7.7, Gray		894-640-A-A
23	Washer Ground, SPTE D14.5 × 0.3t, Natural		660-996
24	Packing Jacks, Silicon Rubber, Black		894-643
25	Panel Top PC, 60 × 30 × 5.7, Black		702-307
26	Ring, Silicon Rubber, D10 × 0.8, Black		894-650
27	Nut Ring, BsBM, D9.5 × 2, Brown		650-346
28	Knob-Channel, ABS D12 × 12, Black		825-757
29	Knob-Volume, ABS D11 × 11, Black		825-756
30	Dust Cap, Neoprene Rubber, Black		830-899-A
31	Antenna Rod, Flexible, Black		420-405
32	Packing (RF Power), Silicon Rubber, D10 × 11.5, Gray		894-642
33	Knob-RF Power, ABS D6.6 × 11.4, Black		852-758
34	Frame, SPTE, 96 × 55 × 24, Ni-Plating, White		718-362-A
35	Spring Coil, D3.5 × 6, Natural		881-504
36	Pin Contant, BsBM, D4.9 × 10, Ni-Plating, White		860-130-A
37	Holder Battery Contact, ABS 21 × 8 × 5		732-751
38	E Ring, D1.5, Black		655-018

Ref. No.	Description	RS Part No.	Mfr's Part No.
39	Terminal		752-255
40	Power Module		220-119-2
41	Heat Sink		716-704
42	Assembly Top PCB		593-167
	Top PCB		416-932-C
43	Insulator, Clear		906-382
44	Shield Plate, CNP3, 66×54×0.15t, White		772-009-C
45	Insulator, Clear		906-383
46	Rubber Sponge 1.0t Black		894-845
47	Insulation Plate, Mylar, D16×0.3t, Clear		906-233
48	Assembly, RF PCB		593-314
	RF PCB		416-966-A
49	Bushing, D4.7×2.6, Sn-Plating, White		852-994
50	Shield Can, 30×20×9, Sn-Plating, White		772-010-A
51	Bushing, D4×3, Ni-Plating, White		853-026
52	Rubber Cap, Silicon, 7.5×2.9×8.5, Clear		894-786
53	Rubber Holder, Silicon, 9.6×4.2, Clear		894-787
54	Assembly VCO PCB		593-318
	VCO PCB		416-967-A
55	Assembly Level PCB		593-162
	Level PCB		416-927-B
56	Assembly MIC PCB		593-164
	MIC PCB		416-924-B
57	Assembly High-Pass Filter PCB		593-163
	High-Pass Filter PCB		416-928-A
58	Assembly Audio PCB 3, Ni-Plating, White		593-161
	Audio PCB		416-925-B
59	Gasket, Silicon Rubber, 270mm, Black		891-370
60	Assembly Auto Power Control PCB		593-317
	Auto Power Control PCB		416-929-B
61	Insulator, Felt, D6×0.3, Black		906-335
62	Cover Bottom A1, 107×63×10.4, Black		718-359-A
63	Label (Serial No.)		959-208-B
64	Label Name, Polyester, 35×18, Black		959-602-A
65	Belt Hook, 304, Black		721-821-A
66	Upper Cover (Battery), PC, 67×60×18, Black		718-361
67	Plate Tension, Sus, 57×26.5×2.5		771-935-A
68	Nut, M2, Hexagon, Brown		651-015
69	Assembly Battery PCB		593-170
	Battery PCB		416-931-A

Ref. No.	Description	RS Part No.	Mfr's Part No.
70	Bracket, SPC, 20×6×12, Ni-Plating, White		723-741
71	Spring, Flat 6×9×11, Ni-Plating, White		881-529
72	Bushing, Acetal, D6×2, White		853-025
73	Pin Contact, D2×15, Ni-Plating, White		860-136
74	Terminal (Input "+"), SPC, 10×5×7, Ni-Plating, White		752-543-A
75	Terminal (Input "-"), SPC, 10×5×7, Ni-Plating, White		752-545-A
76	Terminal (Output "+", "-"), SPC, 6×5.5×5, Ni-Plating White		752-583
77	Bottom Cover (Battery), PC, 67×60×18, Black		718-370
78	Overlay, PVC, 30.9×8.8×0.5t Black		795-414
79	Finger Strip Becup "+", 0.16		905-972
80	Shield Insulator 0.05t		906-423
81	Recycle Label Wood Paper 40×10-1S, Ni-Plate		959-672-A
82	Heat Sink Best 1.0t		761-516
S1	"+" Tapping Screw (PH), 1.8×4-2S, Ni-Plate		628-094
S2	"+" Tapping Screw (PH), 2.6×6-1S, Ni-Plate		621-026
S3	"+" Machine Screw (PH), 2×5, Black		612-285
S4	"+" Machine Screw (FH), 2.6×8 Ni-Plate		611-311
S5	"+" Machine Screw (PH), 2×6 Black		612-045
S6	"+" Machine Screw (PH), 2×5 Ni-Plate		600-615
S7	"+" Machine Screw (BH), 3×4 Black		613-536
S8	"+" Tapping Screw (PH) 2×4-2S Ni-Plate		622-204
S9	"+" Tapping Screw (BH), 2×6-1S Zn-Plate		622-039
S11	"+" Machine Screw (FH), 2×4, Black		612-230
S13	"+" Tapping Screw (PH), 2×17-1S, Black		622-205
S14	"+" Machine Screw (PH), 2.6×5, Ni-Plate		611-032
S15	"+" Machine Screw (FH), 2×5, Ni-Plate		612-220
S16	"+" Machine Screw (RH), 2×4, Ni-Plate		612-286
J1	Connector, Antenna, BNC-RB (M3), SW 1850		421-651-3
J2	DC Power, External MOJ-D15		420-709-5
J3	Miniature, Speaker, HSJ0836-01-50		420-706-2
J4	Miniature, MIC, HSJ1102-01-510		420-709-6
SW801	Push Lock, SPPJ422BP011, RF Power Sw		432-027-8
SW802	Rotary, EC09P20-04, Channel switch		450-524-6
VR801	Variable, 20KA, Audio Volume/Switch		450-523-5
VR802	Variable, 20KB, Squelch Vlume		430-063-0
SPK1	Speaker, 8 ohm, 0.5W, 40mm		420-164-5A
MC1	MIC, Condenser WH-063T, 6DIA		420-206-0
SW401	Switch, Tact, Chip, SKHUPF 7.2×8.5		436-030-0
SW402	Switch, Tact, Chip, SKHUPF 7.2×8.5		436-030-0

Ref. No.	Description	RS Part No.	Mfr's Part No.
SW403	Switch, Tact, Chip, SKHUPF 7.2×8.5		436-030-0
SW404	Switch, Tact, Chip, SKHUPF 7.2×8.5		436-030-0
LCD1001	LE-0820A, Display		252-092-0
LCD901	LED lamp, KRA124, R3d		251-007-9
BAT101	Battery, Lithium, 3V, 3.8×15mm		420-564-3
BAT901	Battery, Ni-Cad, 7.2V 600mAh, 6VEAA		420-567-6
<b>Dry Battery Assembly</b>			
1	Plate, Tension, Sus, 57×26, 5×2.5, Natural Color		771-935-C
2	Housing, Battery (Dry), PC, 65×52×25, Black		718-360-A
3	Holder, Battery (Dry), PC, 61×5×29, Black		732-753
4	Terminal "A" Sus, 27×11.5, Natural		752-547
5	Terminal "-", Sus, 12.7×11.5, Natural		752-550
6	Terminal "B," Sus, 27×11.5, Natural		752-546
7	Terminal "+" Sus, 27×13×11.5, Natural		752-549
8	Terminal "C," Sus, 24.5×13, Natural		752-548
S1	"+" Machine Screw (PH), 2×4-2S Ni-Plate		622-204
S2	"+" Tapping Screw (RH), 2×5, Ni-Plate		632-002
S3	Contact Screw M2×4, Ni-Plate		600-724

# ELECTRICAL PARTS LIST

Ref. No.	Description	RS Part No.	Mfr's. Part No.
<b>Assembly, RF PCB</b>			
<b>Capacitors</b>			
C1	Ceramic, Chip, 15pF 50V, 0805, $\pm 5\%$		131-511-0
C2	Ceramic, Chip, 8pF 50V, 0805, $\pm 5\%$		138-004-4
C3	Ceramic, Chip, 4pF 50V, 0805, $\pm 5\%$		134-007-7
C4	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
C5	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm 20\%$		141-046-0
C6	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C9	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
C10	Electrolytic, 10 $\mu$ F 16V, 4Dia $\times$ 7, $\pm 20\%$		101-043-5
C12	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C13	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
C15	Ceramic, Chip, 47pF 50V, 0805, $\pm 5\%$		134-721-8
C16	Ceramic, Chip, 10pF 50V, 0805, $\pm 0.25\%$		131-039-1
C17	Ceramic, Chip, 4pF 50V, 0805, $\pm 5\%$		134-007-7
C18	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C19	Ceramic, Chip, 47pF 50V, 0805, $\pm 5\%$		134-721-8
C20	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm 5\%$		130-177-7
C21	Ceramic, Chip, 8pF 50V, 0805, $\pm 5\%$		138-004-4
C22	Ceramic, Chip, 15pF 50V, 0805, $\pm 5\%$		131-511-0
C23	Ceramic, Chip, 8pF 50V, 0805, $\pm 5\%$		138-004-4
C24	Ceramic, Chip, 0.01 $\mu$ F 50V, 0805, $\pm 10\%$		130-172-2
C25	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm 20\%$		141-046-0
C26	Electrolytic, 220 $\mu$ F 10V, 6.3Dia $\times$ 7, $\pm 20\%$		102-288-5
C27	Ceramic, Chip, 0.01 $\mu$ F 50V, 0805, $\pm 10\%$		130-172-2
C28	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
C29	Ceramic, Chip, 33pF 50V, 0805, $\pm 5\%$		133-314-9
C31	Ceramic, Chip, 47pF 50V, 0805, $\pm 5\%$		134-721-8
C32-C33	Ceramic, Chip, 8pF 50V, 0805, $\pm 5\%$		138-004-4
C34-C35	Ceramic, Chip, 3.3pF 50V, 0805, $\pm 5\%$		133-321-5
C36	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
C38	Electrolytic, 100 $\mu$ F 16V, 6.3Dia $\times$ 7, $\pm 20\%$		101-093-0
C39-C41	Ceramic, Chip, 8pF 50V, 0805, $\pm 5\%$		138-004-4
C42	Ceramic, Chip, 22pF 50V, 0805, $\pm 5\%$		132-223-5
C43	Ceramic, Chip, 10pF 50V, 0805, $\pm 0.25\%$		131-039-1
C44-C46	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm 10\%$		130-184-4
C47	Tantalum, Chip, 4.7 $\mu$ F 10V, A, $\pm 20\%$		144-722-2
C48	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
C49	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm 20\%$		141-046-0
C50	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C51-C52	Ceramic, Chip, 0.01 $\mu$ F 50V, 0805, $\pm 10\%$		130-172-2
C53-C54	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
C55	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C56	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm 10\%$		130-184-4

Ref. No.	Description	RS Part No.	Mfr's. Part No.
C57	Ceramic, Chip, 0.1 $\mu$ F 50V, 0805, $\pm$ 10%		130-176-6
C58	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm$ 10%		130-184-4
C59-C60	Ceramic, Chip, 220pF 50V, 0805, $\pm$ 5%		132-220-2
C61	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C62	Ceramic, Chip, 33pF 50V, 0805, $\pm$ 5%		133-314-9
C63	Ceramic, Chip, 10pF 50V, 0805, $\pm$ 0.25pF		131-039-1
C64	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C65	Ceramic, Chip, 39pF 50V, 0805, +80% $\pm$ 5%		133-932-7
C66-C67	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C68	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0
C69	Tantalum, Chip, 1 $\mu$ F 16V, A, $\pm$ 20%		141-036-1
C70	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C71	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0
C72	Electrolytic, 100 $\mu$ F 16V, 6.3Dia $\times$ 7, $\pm$ 20%		101-093-0
C73	Ceramic, Chip, 220pF 50V, 0805, $\pm$ 5%		132-220-2
C74	Tantalum, Chip, 4.7 $\mu$ F 10V, A, $\pm$ 20%		144-722-2
C75	Ceramic, Chip, 0.1 $\mu$ F 50V, 0805, $\pm$ 10%		130-176-6
C76	Ceramic, Chip, 22pF 50V, 0805, $\pm$ 5%		132-223-5
C77	Ceramic, Chip, 39pF 50V, 0805, $\pm$ 5%		133-932-7
C78	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C79	Ceramic, Chip, 0.01 $\mu$ F 50V, 0805, $\pm$ 10%		130-172-2
C80	Tantalum, Chip, 1 $\mu$ F 16V, A, $\pm$ 20%		141-036-1
C82	Ceramic, Chip, 0.1 $\mu$ F 50V, 0805, $\pm$ 10%		130-176-6
C83	Electrolytic, 100 $\mu$ F 16V, 6.3Dia $\times$ 7, $\pm$ 20%		101-093-0
C84	Ceramic, Chip, 270pF 50V, 0805, $\pm$ 5%		132-710-8
C85	Ceramic, Chip, 220pF 50V, 0805, $\pm$ 5%		132-220-2
C86-C87	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C88-91	Ceramic, Chip, 220pF 50V, 0805, $\pm$ 5%		132-220-2
C92-C93	Ceramic, Chip, 47pF 50V, 0805, $\pm$ 5%		134-721-8
C95	Ceramic, Chip, 5pF 50V, 0805, $\pm$ 0.25pF		135-010-4
C97	Ceramic, Chip, 0.5pF 50V, 0805, $\pm$ 5%		130-504-9
TC1	Trimmer, 6pF (ECR-LA020E52V), +5%, -0%		176-014-5
	<b>Connectors</b>		
CON1	Lead/Housing Assembly, 4P, 50mm		504-808
CON2	Lead/Housing Assembly 5mm		504-809
	<b>Coils/Transformers</b>		
L1	Spring, 2 $\times$ 0.5 $\times$ 4t:L		310-197-1
L2	Spring, 3 $\times$ 0.6 $\times$ 1.5t:L		310-805-7
L3	Spring, 3.6 $\times$ 0.6 $\times$ 1.5t:R		310-618-5
L4	Spring, 3.6 $\times$ 0.6 $\times$ 1.5t:R		310-618-5
L5	Spring, 2 $\times$ 0.5 $\times$ 4t:L		310-197-1
L6	Spring, 2.5 $\times$ 0.55 $\times$ 2.5t:L		310-806-8
L7	Spring, 2.5 $\times$ 0.55 $\times$ 2.5t:L		310-806-8
L8	Spring, 2.5 $\times$ 0.55 $\times$ 2.5t:L		310-806-8
L9-L10	Coil FB-64-5111		509-772

Ref. No.	Description	RS Part No.	Mfr's.Part No.
L13	Inductor, Chip, 0.33 $\mu$ H, 01, $\pm$ 10%		310-709-4
L14	Inductor, Axial, 100 $\mu$ H, 04, $\pm$ 10%		310-221-9
L15	Inductor, Chip, 1 $\mu$ H, 01, $\pm$ 20%		310-657-0
L16	Inductor, Chip, 0.33 $\mu$ H, 01, $\pm$ 10%		310-709-4
T1	Helical, 5mm, Square, Twin White		320-963-9
T5	IFT, 45MHz, 5mm, Square, Black		320-962-8
T8	Transformer, Detector, 455kHz, 5mm Square, Black		320-232-2
	<b>Crystals</b>		
X1	12.860MHz, 5PPM		262-716-4
X2	44.545MHz. $\pm$ 10PPM		261-932-7
	<b>Diodes</b>		
D1	1SS241, Chip, Pin		243-073-5
D2	1SS97, Axial, Schottky, Detector		243-026-3
D3	BZX84, SOT-23, 6.2V		241-131-4
D4	IN5819, Axial, Rectifier		245-024-1
D5	IN5819, Axial, Rectifier		245-024-1
D6	1SS241, Chip, Pin.		243-073-5
D7	MMBV3401(4D), SOT-23, Pin		243-012-0
D8	MMBV3401(4D), SOT-23, Pin		243-012-0
	<b>Filters</b>		
CF1	Ceramic, CFW455F, 455kHz		270-027-8
XF1	Crystal, 45S15A, 45MHz		271-045-9
	<b>ICs</b>		
40	M57797MA, Power MDL, 430-450MHz		220-119-2
IC1	MC145191F, SO-16, PLL		220-131-3
IC2	MC14094BD, SO-16, Shift-Resistor		223-233-7
IC3	TK11650NT, 5V, Regulator		229-523-9
IC4	MC3371DR2, SO-16, FM IF		223-421-0
	<b>Jacks</b>		
J2	DC Power, EXT., MOJ-D15		420-709-5
J3	Miniature, Speaker, HSJ0836-01-50		420-706-2
J4	Miniature, MIC, HSJ1102-01-510		420-709-6
	<b>Resistors Carbon</b>		
R1	Chip, 10kohm, 1/10W, 0805, $\pm$ 5%		060-103-8
R2	Chip, 10kohm, 1/10W, 0805, $\pm$ 5%		060-103-8
R3	Chip, 10kohm, 1/10W, 0805, $\pm$ 5%		060-103-8
R4	Chip, 330kohm, 1/10W, 0805, $\pm$ 5%		060-331-7
R5	Chip, 1kohm, 1/10W, 0805, $\pm$ 5%		060-102-7
R6	Chip, 6.8kohm, 1/10W, 0805, $\pm$ 5%		060-472-1
R7	Chip, 10kohm, 1/10W, 0805, $\pm$ 5%		060-103-8
R8	Chip, 10kohm, 1/10W, 0805, $\pm$ 5%		060-100-5
R10	Chip, 2.2kohm, 1/10W, 0805, $\pm$ 5%		060-222-2

Ref. No.	Description	RS Part No.	Mfr's. Part No.
R11	Chip, 220 ohm, 1/10W, 0805, $\pm 5\%$		060-221-1
R12	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R13	Chip, 220 ohm, 1/10W, 0805, $\pm 5\%$		060-221-1
R14	Chip, 220 ohm, 1/10W, 0805, $\pm 5\%$		060-221-1
R15	Chip, 5.6K ohm, 1/10W, 0805, $\pm 5\%$		060-562-9
R16	Chip, 100 ohm, 1/10W, 0805, $\pm 5\%$		060-101-6
R17	Chip, 22K ohm, 1/10W, 0805, $\pm 5\%$		060-223-3
R18	Chip, 4.7K ohm, 1/10W, 0805, $\pm 5\%$		060-472-1
R19	Chip, 2.2 ohm, 1/10W, 0805, $\pm 5\%$		060-229-9
R20	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R21	Chip, 22K ohm, 1/10W, 0805, $\pm 5\%$		060-223-3
R23	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R24	Chip, 4.7K ohm, 1/10W, 0805, $\pm 5\%$		060-472-1
R26	Chip, 47K ohm, 1/10W, 0805, $\pm 5\%$		060-473-2
R27	Chip, 470K ohm, 1/10W, 0805, $\pm 5\%$		060-474-3
R28	Chip, 22K ohm, 1/10W, 0805, $\pm 5\%$		060-223-3
R29	Chip, 470K ohm, 1/10W, 0805, $\pm 5\%$		060-474-3
R30	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R31	Chip, 200K(180K~200K) ohm, 1/10W, 0805, $\pm 5\%$		060-204-6
R32	Chip, 56K ohm, 1/10W, 0805, $\pm 5\%$		060-563-0
R33	Chip, 43K(39K~43K) ohm, 1/10W, 0805, $\pm 5\%$		060-433-6
R34	Chip, 100K ohm, 1/10W, 0805, $\pm 5\%$		060-104-9
R36	Chip, 330K ohm, 1/10W, 0805, $\pm 5\%$		060-334-0
R39	Chip, 22K ohm, 1/10W, 0805, $\pm 5\%$		060-223-3
R40	Chip, 10 ohm, 1/10W, 0805, $\pm 5\%$		060-100-5
R41	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R42	Chip, 8.2K ohm, 1/10W, 0805, $\pm 5\%$		060-822-4
R43	Chip, 1Mohm, 1/10W, 0805, $\pm 5\%$		060-105-0
R44	Chip, 330K ohm, 1/10W, 0805, $\pm 5\%$		060-334-0
R45	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R48	Chip, 22K ohm, 1/10W, 0805, $\pm 5\%$		060-223-3
R49	Chip, 1.8K ohm, 1/10W, 0805, $\pm 5\%$		060-182-9
R50	Chip, 1.8K ohm, 1/10W, 0805, $\pm 5\%$		060-182-9
R51	Chip, 6.8K ohm, 1/10W, 0805, $\pm 5\%$		060-682-4
R52	Chip, 470K ohm, 1/10W, 0805, $\pm 5\%$		060-474-3
R53	Chip, 330 ohm, 1/10W, 0805, $\pm 5\%$		060-331-7
R54	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R55	Chip, 1.8K ohm, 1/10W, 0805, $\pm 5\%$		060-182-9
R61	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R62	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R63	Chip, 330K ohm, 1/10W, 0805, $\pm 5\%$		060-334-0
RV1	Semifixed, 22KB, 6Dia		071-223-1
RV2	Semifixed, 22KB, 6Dia		071-223-1
RV3	Semifixed, RH03A3A15J, Chip		067-104-5



Ref. No.	Description	RS Part No.	Mfr's. Part No.
	<b>Transistors/FETS</b>		
Q1	BCX-18LT1, SOT-23,		203-111-4
Q2	2SC3606, SOT-23, NPN		201-057-9
Q3	2SC3606, SOT-23, NPN		201-057-9
Q4	2SC3120, SOT-23, NPN		201-051-3
Q5	KRC110S(NK), SOT-23, NPN		202-096-9
Q6	KRA110S(PK), SOT-23, PNP		202-092-5
Q7	KRA110S(PK), SOT-23, PNP		202-092-5
Q11	KRC110S(NK), SOT-23, NPN		202-096-9
Q12	KRA110S(PK), SOT-23, PNP		202-092-5
Q13	KTA1504S(ASG), SOT-23, PNP		202-082-6
Q14	KTC3875S(ALG), SOT-23, NPN		202-083-7
Q15	MMBC1321(Q4), SOT-23, NPN		203-096-4
	<b>End of Assembly-RF PCB</b>		
<b>Assembly, Digital PCB</b>			
	<b>Capacitors</b>		
C1001	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C1002	Tantalum, Chip, 1 $\mu$ F 16V, A, $\pm$ 20%		141-036-1
C1003	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0
C1004	Ceramic, Chip, 470pF 50V, 0805, $\pm$ 10%		134-761-4
C1005	Tantalum, Chip, 0.22 $\mu$ F 35V, A, $\pm$ 20%		140-204-1
C1007	Ceramic, Chip, 0.022 $\mu$ F 50V, 0805, $\pm$ 5%		130-234-5
C1008	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm$ 10%		130-184-4
C1009, C1010	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0
C1011, C1012	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C1014	Ceramic, Chip, 47pF 50V, 0805, $\pm$ 5%		134-721-8
C1015	Ceramic, Chip, 47pF 50V, 0805, $\pm$ 5%		134-721-8
C1016	Ceramic, Chip, 10pF 50V, 0805, $\pm$ 5%		131-017-1
C1017	Ceramic, Chip, 0.01 $\mu$ F 50V, 0805, $\pm$ 10%		130-172-2
C1018	Ceramic, Chip, 10pF 50V, 0805, $\pm$ 5%		131-017-1
C1019-C1021	Ceramic, Chip, 0.01 $\mu$ F 50V, 0805, $\pm$ 10%		130-172-2
C1022	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0
C1023	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C1024	Ceramic, Chip 0.001 $\mu$ F 25V, 0805, +80% -20%		130-184-4
C1025	Ceramic, Chip 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C1026	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0
C1028	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm$ 10%		130-184-4
C1029	Ceramic, Chip, 0.1 $\mu$ F 50V, 0805, $\pm$ 5%		130-198-6
C1030	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm$ 10%		130-184-4
C1031	Ceramic, Chip, 220pF 50V, 0603, $\pm$ 5%		132-270-7
C1032	Ceramic, Chip, 220pF 50V, 0603, $\pm$ 5%		132-270-7
C1033	Ceramic, Chip, 220pF 50V, 0603, $\pm$ 5%		132-270-7

Ref. No.	Description	RS Part No.	Mfr's. Part No.
C1034	Ceramic, Chip, 220pF 50V, 0603, $\pm 5\%$		132-270-7
	<b>Connectors</b>		
CON1001	Wafer, 8283-0312, 3Pin, 2mm Film, Flexible, 66.5 $\times$ 59.2, 26Pin, Large Film, Flexible, 27.2 $\times$ 21.5, 9Pin, Small		422-275-2 416-933-B 416-942-A
X1001	Crystal, 3.579545MHz, 50PPM, TC-38A		262-253-2
	<b>Diodes</b>		
D1001	KDS193S(F3), SOT-23, Switching		233-052-6
D1002	RB471E, FMD(Dual), Schottky Rectifier		249-043-8
D1003	KDS193S(F3), SOT-23, Switching		233-052-6
D1004	RB471E, FMD(Dual), Schottky Rectifier		249-043-8
D1005	RB471E, FMD(Dual), Schottky Rectifier		249-043-8
D1006	KDS193S(F3), SOT-23, Switching		233-052-6
D1007	RB471E, FMD(Dual), Schottky Rectifier		249-043-8
D1008	RB471E, FMD(Dual), Schottky Rectifier		249-043-8
	<b>ICs</b>		
IC1001	TK11650NT		229-523-9
IC1002	MF6CWM-100, SO-16L, Switched Capacitor		231-073-3
IC1003	MC142100DW, SO-16L, Crosspoint Switch		223-378-5
IC1004	KS58015D, DTMF, Generator		231-069-9Z
IC1005	S8054ALR-LN, SOT-89, Voltage Detector		229-446-3
IC1006	HD4074818FS, QFP-80, CPU		220-166-5
IC1007	MC145436DW, SO-16L, DTMF Receiver		223-419-9
IC1008	MC74HC4078D, SO-14, 8-Input NOR/OR Gate		223-420-9
IC1009	KIA393/LM393, SO-8, Comparator		222-022-8
L1001	1 $\mu$ H: LER015TIROM		310-657-0
L1002	1 $\mu$ H: LER015TIROM		310-657-0
L1003	Inductor, Actial, 100 $\mu$ H, 04, $\pm 10\%$		310-221-9
LCD1001	LCD, LE-0802A, Display		252-092-0
LED1001	LED Lamp, SLP-378H, Backlight Yellow		251-184-5
LED1002	LED Lamp, SLP-378H, Backlight Yellow		251-184-5
	<b>Resistors, Carbon</b>		
R1001	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1002	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1003	Chip, 47K ohm, 1/10W, 0805, $\pm 5\%$		060-473-2
R1004	Chip, 47K ohm, 1/10W, 0805, $\pm 5\%$		060-473-2
R1005	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R1006	Chip, 220K ohm, 1/10W, 0805, $\pm 5\%$		060-224-4
R1007	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R1008	Chip, 1Mohm, 1/10W, 0805, $\pm 5\%$		160-105-0
R1009	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R1010	Chip, 15K ohm, 1/10W, 0805, $\pm 5\%$		060-153-3

Ref. No.	Description	RS Part No.	Mfr's. Part No.
R1011	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R1012	Chip, 33 ohm, 1/10W, 0805, $\pm 5\%$		060-330-6
R1013	Chip, 100K ohm, 1/10W, 0805, $\pm 5\%$		060-104-9
R1014	Chip, 100K ohm, 1/10W, 0805, $\pm 5\%$		060-104-9
R1015	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R1016	Chip, 1Mohm, 1/10W, 0805, $\pm 5\%$		060-105-0
R1017	Chip, 47K ohm, 1/10W, 0805, $\pm 5\%$		060-473-2
R1018	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1019	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1020	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1022	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1023	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1024	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1025	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1026	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1027	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1028	Chip, 39K ohm, 1/10W, 0805, $\pm 5\%$		060-393-3
R1029	Chip, 20K ohm, 1/10W, 0805, $\pm 5\%$		060-203-5
R1030	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
R1031	Chip, 47K ohm, 1/10W, 0805, $\pm 5\%$		060-473-2
R1036	Chip, 47K ohm, 1/10W, 0805, $\pm 5\%$		060-473-2
R1037	Chip, 47K ohm, 1/10W, 0805, $\pm 5\%$		060-473-2
R1038	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1039	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R1040	Chip, 1Mohm, 1/10W, 0603, $\pm 5\%$		05B-105-7
R1041	Chip, 100K ohm, 1/10W, 0805, $\pm 5\%$		060-104-9
R1042	Chip, 39 ohm, 1/10W, 0805, $\pm 5\%$		060-393-3
R1043	Chip, 39 ohm, 1/10W, 0805, $\pm 5\%$		060-393-3
R1044	Chip, 39 ohm, 1/10W, 0805, $\pm 5\%$		060-393-3
R1045	Chip, 39 ohm, 1/10W, 0805, $\pm 5\%$		060-393-3
R1046	Chip, 39 ohm, 1/10W, 0805, $\pm 5\%$		060-393-3
R1048	Chip, 27K ohm, 1/10W, 0603, $\pm 5\%$		05B-273-5
R1049	Chip, 27K ohm, 1/10W, 0603, $\pm 5\%$		05B-273-5
R1050	Chip, 27K ohm, 1/10W, 0603, $\pm 5\%$		05B-273-5
R1051	Chip, 27K ohm, 1/10W, 0603, $\pm 5\%$		05B-273-5
RV1001	Semifixed Chip, 1KB ohm, 4mm		067-102-2
RV1002	Semifixed Chip, 47KB ohm, 4mm		067-473-7
	<b>Transistors</b>		
Q1001	KRA110S(PK), SOT-23, PNP		202-092-5
Q1002	KTC3875S(ALG), SOT-23, NPN		202-083-7
Q1003	KTN2222S(ZB), SOT-23, NPN		202-158-2
Q1004	KRA110S(PK), SOT-23, PNP		202-092-5
Q1005	KRA110S(PK), SOT-23, PNP		202-092-5
Q1006	KRC104S(ND), 30 $\times$ 12 $\times$ 1.0t, FR4 Blank End of Assembly-Digital PCB		202-095-8

Ref. No.	Description	RS Part No.	Mfr's.Part No.
<b>Assembly, Audio PCB</b>			
	<b>Resistors, Carbon</b>		
R601	Chip, 470K ohm, 1/10W, 0805, $\pm 5\%$		060-474-3
R602	Chip, 470K ohm, 1/10W, 0805, $\pm 5\%$		060-474-3
R603	Chip, 100 ohm, 1/10W, 0805, $\pm 5\%$		060-101-6
R604	Chip, 22K ohm, 1/10W, 0805, $\pm 5\%$		060-223-3
R605	Chip, 1K ohm, 1/10W, 0805, $\pm 5\%$		060-102-7
R606	Chip, 47K ohm, 1/10W, 0805, $\pm 5\%$		060-473-2
R607	Chip, 10K ohm, 1/10W, 0805, $\pm 5\%$		060-103-8
	<b>Capacitors</b>		
C601	Ceramic, Chip, 0.047 $\mu$ F 50V, 0805, $\pm 10\%$		130-417-4
C602	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm 20\%$		141-046-0
C603	Tantalum, Chip, 1 $\mu$ F 16V, A, $\pm 20\%$		141-036-1
C604	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C605	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm 10\%$		130-184-4
C606	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm 10\%$		130-184-4
C607	Tantalum, Chip, 0.68 $\mu$ F 16V, A, $\pm 20\%$		140-606-1
	<b>Transistors</b>		
Q601	KTA1504S(ASG), SOT-23, PNP		202-082-6
Q602	KRC104S(ND), SOT-23, NPN		202-095-8
Q603	KRC104S(ND), SOT-23, NPN		202-095-8
CON601	Connector Pin, Angle, 7Pin, 2mm Pitch		422-374-8
IC601	IC, LM386-N3, Dip-8, Audio AMP.		231-008-4
	<b>End of Assembly-Audio PCB</b>		
<b>Assembly, Level PCB</b>			
	<b>Capacitors</b>		
C304	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C305	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C306	Tantalum, Chip, 1 $\mu$ F 16V, A, $\pm 20\%$		141-036-1
	<b>Resistors, Carbon</b>		
R309	Chip, 1Mohm, 1/10W, 0805, $\pm 5\%$		060-105-0
R310	Chip, 12K ohm, 1/10W, 0805, $\pm 5\%$		060-123-6
R312	Chip, 2.2K ohm, 1/10W, 0805, $\pm 5\%$		060-222-2
R311	Chip, 22K ohm, 1/10W, 0805, $\pm 5\%$		060-223-3
R307	Chip, 27K ohm, 1/10W, 0805, $\pm 5\%$		060-273-8
R308	Chip, 56K ohm, 1/10W, 0805, $\pm 5\%$		060-563-0
R306	Chip, 82K ohm, 1/10W, 0805, $\pm 5\%$		060-823-5
CON301	Connector Pin, Angle, 10Pin, 2mm Pitch		422-373-7
IC301	IC, LM339M, SO-14, Quad Comparator		228-029-5

Ref. No.	Description	RS Part No.	Mfr's. Part No.
	<b>End of Assembly, Level PCB</b>		
<b>Assembly, High-Pass Filter PCB</b>			
	<b>Capacitors</b>		
C501-C508	Ceramic, Chip, 0.047 $\mu$ F 25V, 0805, $\pm$ 5%		130-425-1
C509	Ceramic, Chip, 0.01 $\mu$ F 50V, 0805, $\pm$ 10%		130-172-2
	<b>Resistors, Carbon</b>		
R501	Chip, 2.7K ohm, 1/10W, 0805, $\pm$ 5%		060-272-7
R502	Chip, 4.7K ohm, 1/10W, 0805, $\pm$ 5%		060-472-1
R503	Chip, 2.2K ohm, 1/10W, 0805, $\pm$ 5%		060-222-2
R504	Chip, 22K ohm, 1/10W, 0805, $\pm$ 5%		060-223-3
R505	Chip, 3.3K ohm, 1/10W, 0805, $\pm$ 5%		060-332-8
R506	Chip, 1.5K ohm, 1/10W, 0805, $\pm$ 5%		060-152-2
R507	Chip, 56K ohm, 1/10W, 0805, $\pm$ 5%		060-563-0
R508	Chip, 12K ohm, 1/10W, 0805, $\pm$ 5%		060-123-6
R509	Chip, 180K ohm, 1/10W, 0805, $\pm$ 5%		060-184-1
R510	Chip, 15K ohm, 1/10W, 0805, $\pm$ 5%		060-153-3
R511	Chip, 680 ohm, 1/10W, 0805, $\pm$ 5%		060-681-3
R512	Chip, 10K ohm, 1/10W, 0805, $\pm$ 5%		060-103-8
R513	Chip, 10K ohm, 1/10W, 0805, $\pm$ 5%		060-103-8
CON501	Connector Pin, Angle, 6Pin, 2mm Pitch		422-371-5
IC501	IC, LM2902M, SO-14, Quad OP AMP End of Assembly, High-Pass Filter PCB		231-082-0
<b>Assembly, MIC PCB</b>			
	<b>Capacitors</b>		
C101	Ceramic, Chip, 0.0018 $\mu$ F 50V, 0805, $\pm$ 10%		130-A22-0
C102	Ceramic, Chip, 0.022 $\mu$ F 50V, 0805, $\pm$ 5%		130-234-5
C103	Ceramic, Chip, 0.0039 $\mu$ F 50V, 0805, $\pm$ 5%		130-329-8
C104	Ceramic, Chip, 0.0056 $\mu$ F 50V, 0805, $\pm$ 10%		130-513-7
C105	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C106	Ceramic, Chip, 0.01 $\mu$ F 50V, 0805, $\pm$ 10%		130-172-2
C107	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C108	Ceramic, Chip, 56pF 50V, 0805, $\pm$ 5%		135-613-9
C109	Ceramic, Chip, 0.022 $\mu$ F 50V, 0805, $\pm$ 5%		130-234-5
C110	Ceramic, Chip, 56pF 50V, 0805, $\pm$ 5%		135-613-9
C111	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C112	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0
	<b>Resistors, Carbon</b>		
R101	Chip, 1K ohm, 1/10W, 0805, $\pm$ 5%		060-102-7
R102	Chip, 10K ohm, 1/10W, 0805, $\pm$ 5%		060-103-8
R103	Chip, 8.2K ohm, 1/10W, 0805, $\pm$ 5%		060-822-4

Ref. No.	Description	RS Part No.	Mfr's. Part No.
R104	Chip, 6.8K ohm, 1/10W, 0805, ±5%		060-682-4
R105	Chip, 15K ohm, 1/10W, 0805, ±5%		060-153-3
R106	Chip, 100K ohm, 1/10W, 0805, ±5%		060-104-9
R107	Chip, 22K ohm, 1/10W, 0805, ±5%		060-223-3
R108	Chip, 10K ohm, 1/10W, 0805, ±5%		060-103-8
R109	Chip, 33K ohm, 1/10W, 0805, ±5%		060-333-9
R110	Chip, 180K ohm, 1/10W, 0805, ±5%		060-184-1
R111	Chip, 2.4K ohm, 1/10W, 0805, ±5%		060-242-0
R112	Chip, 270K ohm, 1/10W, 0805, ±5%		060-274-9
R113	Chip, 6.8K ohm, 1/10W, 0805, ±5%		060-682-4
CON101	Connector Pin, Angle, 8Pin, 2mm Pitch		422-372-6
IC101	IC, LM2902M, SO-14, Quad OP AMP End of Assembly, MIC PCB		231-082-0
<b>Assembly, Auto Power Control PCB</b>			
	<b>Capacitors</b>		
C701-704	Ceramic, Chip, 220pF 50V, 0805, ±5%		132-220-2
	<b>Resistors, Carbon</b>		
R701	Chip, 47K ohm, 1/10W, 0805, ±5%		060-473-2
R702	Chip, 10K ohm, 1/10W, 0805, ±5%		060-103-8
R703	Chip, 1K ohm, 1/10W, 0805, ±5%		060-102-7
R704	Chip, 10K ohm, 1/10W, 0805, ±5%		060-103-8
R705	Chip, 10K ohm, 1/10W, 0805, ±5%		060-103-8
R706	Chip, 1K ohm, 1/10W, 0805, ±5%		060-102-7
R707	Chip, 10K ohm, 1/10W, 0805, ±5%		060-103-8
R708	Chip, 1K ohm, 1/10W, 0805, ±5%		060-102-7
CON701	Connector Pin, Angle, 6Pin, 2mm Pitch		422-371-5
	<b>Transistors</b>		
Q701	LSP966, TO-92L, PNP		203-054-6
Q702-Q704	KTC3875S(ALG), SOT-23, NPN End of Assembly, Auto Power Control PCB		202-083-7
<b>Assembly, PTT PCB</b>			
	<b>Capacitors</b>		
C401	Ceramic, Chip, 0.01 μF 50V, 0805, ±10%		130-172-2
C402	Ceramic, Chip, 0.1 μF 25V, 0805, +80% -20%		130-185-5
C403-C406	Ceramic, Chip, 0.015 μF 50V, 0805, ±5%		130-A14-3
C408	Ceramic, Chip, 0.0033 μF 50V, 0805, ±5%		130-328-7
C409	Ceramic, Chip, 0.0022 μF 50V, 0805, ±5%		130-237-8
C410	Ceramic, Chip, 0.0082 μF 50V, 0805, ±5%		130-805-1
C411	Ceramic, Chip, 470pF 50V, 0805, ±5%		134-726-3
C412	Ceramic, Chip, 0.1 μF 25V, 0805, +80% -20%		130-185-5

Ref. No.	Description	RS Part No.	Mfr's. Part No.
C413	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0
	<b>Resistors, Carbon</b>		
R401	Chip, 2K ohm, 1/10W, 0805, $\pm$ 5%		060-202-4
R402	Chip, 20K ohm, 1/10W, 0805, $\pm$ 5%		060-203-5
R403	Chip, 33K ohm, 1/10W, 0805, $\pm$ 5%		060-333-9
R404	Chip, 8.2K ohm, 1/10W, 0805, $\pm$ 5%		060-822-4
R405	Chip, 15K ohm, 1/10W, 0805, $\pm$ 5%		060-153-3
R406	Chip, 3.9K ohm, 1/10W, 0805, $\pm$ 5%		060-392-2
R407	Chip, 75K ohm, 1/10W, 0805, $\pm$ 5%		060-753-5
R408	Chip, 47K ohm, 1/10W, 0805, $\pm$ 5%		060-473-2
R409	Chip, 47K ohm, 1/10W, 0805, $\pm$ 5%		060-473-2
R411	Chip, 47K ohm, 1/10W, 0805, $\pm$ 5%		060-473-2
R412	Chip, 47K ohm, 1/10W, 0805, $\pm$ 5%		060-473-2
IC401	IC, LM2902M, SO-14, Quad OP AMP		231-082-0
SW401-SW404	Switch, Tact, Chip, SKHUPF, 7.2 $\times$ 8.5 End of Assembly, PTT PCB		436-030-0
<b>Assembly, TOP PCB</b>			
	<b>Resistors</b>		
R802	Fixed, Metalfilm, 6.8K ohm, 1/8W, $\pm$ 5%		001-682-1
VR801	Variable, 20KA, Audio Volume/Switch		450-523-5
VR802	Variable, 20KB, Squelch		450-524-6
	<b>Connectors</b>		
CON801	Wafer, 8283-0412, 4Pin, 2mm Pitch		422-265-3
CON802	Wafer, 8283-0612, 6Pin, 2mm Pitch		422-266-4
	<b>Switches</b>		
SW801	Push Lock, SPPJ422BP011, RF Power		432-027-8
SW802	Rotary, EC09P20-04, Channel End of Assembly, Top PCB		430-063-0
<b>Assembly, VCO PCB</b>			
	<b>Capacitors</b>		
C201	Ceramic, Chip, 220pF 50V, 0805, $\pm$ 5%		132-220-2
C202	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C203	Ceramic, Chip, 5pF 50V, 0805, $\pm$ 5%		135-010-4
C205	Ceramic, Chip, 10pF 50V, 0805, $\pm$ 5%		131-039-1
C206	Ceramic, Chip, 220pF 50V, 0805, $\pm$ 5%		132-220-2
C207	Ceramic, Chip, 0.5pF 50V, 0805, $\pm$ 5%		130-504-9
C208	Ceramic, Chip, 22pF 50V, 0805, $\pm$ 5%		132-223-5
C209	Ceramic, Chip, 5-6pF(N220) 50V, 0805, $\pm$ 5%		135-636-0
C210	Ceramic, Chip, 8pF 50V, 0805, $\pm$ 5%		138-004-4
C211	Tantalum, Chip, 10 $\mu$ F 10V, B, $\pm$ 20%		141-046-0

Ref. No.	Description	RS Part No.	Mfr's Part No.
C212	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
C213	Ceramic, Chip, 0.001 $\mu$ F 50V, 0805, $\pm 10\%$		130-184-4
C215	Tantalum, Chip, 10 $\mu$ F 4V, A, $\pm 20\%$		141-044-8
C216	Ceramic, Chip, 0.1 $\mu$ F 25V, 0805, +80% -20%		130-185-5
C217	Ceramic, Chip, 22pF(N750) 50V, 0805, $\pm 5\%$		132-261-9
C218	Ceramic, Chip, 220pF 50V, 0805, $\pm 5\%$		132-220-2
	<b>Coils</b>		
L201	Spring, 1.5 $\times$ 0.35 $\times$ 4t:R		310-804-6
L202	Inductor, Chip, 1 $\mu$ F, 01, $\pm 20\%$		310-657-0
L203	Inductor, Chip, 1 $\mu$ F, 01, $\pm 20\%$		310-657-0
L204	Spring, 1.5 $\times$ 0.35 $\times$ 4t R		310-804-6
L205	Inductor, Chip, 0.33 $\mu$ H, 01, $\pm 10\%$		310-709-4
L206	Inductor, Chip, 1 $\mu$ F, 01, $\pm 20\%$		310-657-0
	<b>Diodes</b>		
D201	Varicap, 1SV153, OSC		243-050-4
D202	Varicap, 1SV153, OSC (or MMBV105, OSC)		243-050-4
D203	Pin, ISS241, R/TX Switching		243-073-5
	<b>Resistors, Carbon</b>		
R201	Chip, 47 ohm, 1/10W, 0805, $\pm 5\%$		060-470-9
R202	Chip, 33K ohm, 1/10W, 0805, $\pm 5\%$		060-333-9
R203	Chip, 33K ohm, 1/10W, 0805, $\pm 5\%$		060-333-9
R205	Chip, 33K ohm, 1/10W, 0805, $\pm 5\%$		060-333-9
R206	Chip, 330 ohm, 1/10W, 0805, $\pm 5\%$		060-331-7
R208-211	Chip, 2.2K ohm, 1/10W, 0805, $\pm 5\%$		060-222-2
R212	Chip, 6.8K ohm, 1/10W, 0805, $\pm 5\%$		060-682-4
R213	Chip, 27K ohm, 1/10W, 0805, $\pm 5\%$		060-273-8
R214	Chip, 100 ohm, 1/10W, 0805, $\pm 5\%$		060-101-6
	<b>Transistors</b>		
Q201	BFR92A, SOT-23, NPN		200-003-5
Q202	BFR92A, SOT-23, NPN		200-003-5
Q203	KRC110S(NK), NPN		202-096-9
Q204	2SC3606, SOT-23, NPN		201-057-9
Q205	BC848C(1L), SOT-23, NPN		200-001-3
CON201	Connector, GDH2-8SBT(7.5), 8Pin, 2mm Pitch End of Assembly, VCO PCB		422-391-3
<b>Assembly, Pack Battery, Ni-Cad</b>			
<b>Assembly, Battery PCB</b>			
D901	Diode, KDS193S(F3), SOT-23, Switching		243-052-6
LED901	Led Lamp, KLR124, RED		251-007-9
	<b>Resistors, Carbon</b>		
R901	Chip, 10 ohm, 1/10W, 0805, $\pm 5\%$		060-100-5



Ref. No.	Description	RS Part No.	Mfr's.Part No.
R902	Chip, 4.7K ohm, 1/10W, 0805, ±5%		060-472-1
R903	Chip, 2.2K ohm, 1/10W, 0805, ±5%		060-222-2
	<b>Transistors</b>		
Q901	KTA1504S(ASG), SOT-23, PNP		202-082-6
Q902	KTA1663(HO), SOT-89, PNP		202-163-6
	<b>End of Assembly, Battery PCB</b>		
BAT901	Battery, Ni-Cad, 7.2V 600mAh, 6VEAA		420-567-6
	<b>End of Assembly, Pack Battery, Ni-CAD</b>		
<b>Miscellaneous</b>			
	<b>Capacitors</b>		
C2001	Ceramic, 470pF 50V, ±10%		134-710-8
C2001	Ceramic, Chip, 470pF 50V, 0805, ±10%		134-761-4
CON2001	Connector, Lead, Housing, 3P, Speaker		504-807
SPK1	Speaker, 8 ohm, 0.5W, 40mm		420-164-5A
MIC1	MIC, Condenser, WH-063T, 6Dia		420-206-0
BAT101	Battery, Lithium, 3V, 3.8 × 15mm		420-564-3
	<b>End of Miscellaneous</b>		

# SEMICONDUCTOR VOLTAGE CHART

- Frequency : 446.100MHz
- Power Supply : 7.2V DC
- Unit : Volts (average)

## 1. Normal Function

### Transistors

Ref. No.	Receive			Transmit		
	E	B	C	E	B	C
Q1	4.92	4.92	0.00	4.83	4.10	4.79
Q2	0.00	0.00	0.00	0.00	0.58	4.50
Q3	0.00	0.76	4.44	0.00	0.00	0.00
Q4	0.71	1.43	4.83	0.00	0.00	0.00
Q6	4.95	4.95	0.00	4.80	0.32	4.77
Q7	4.90	0.40	4.81	4.81	4.81	0.00
Q12	4.90	0.21	4.78	4.81	0.20	4.69
Q13	4.91	4.75	0.00	4.81	4.65	0.00
Q14	0.00	0.00	0.00	5.36	6.11	6.71
Q15	0.00	0.58	4.90	0.00	4.62	4.81

### Diodes

Ref. No.	Receive		Transmit	
	A	C	A	C
D1	0.00	0.72	2.80	2.00
D2	0.00	0.00	0.35	3.47
D3	0.00	0.30	0.00	6.14
D4	7.20	6.98	7.20	6.80
D5	1.13	0.37	0.00	2.00

### IC

Pin No.	Receive				Transmit				TX	RX
	IC1	IC2	IC3	IC4	IC1	IC2	IC3	IC4		
1	2.25	0.00	6.95	4.72	2.21	0.00	6.80	0.00	0.13	0.00
2	4.9	4.70	0.00	4.03	4.81	4.70	0.00	0.00	6.29	0.00
3	4.9	0.00	5.00	3.81	4.81	0.00	5.00	0.00	5.11	0.00
4	4.9	4.95	—	4.80	4.81	4.92	—	0.00	6.52	7.00
5	4.9	4.95	—	3.79	4.81	4.92	—	0.00	1.67	0.00
6	3.25	4.95	—	3.82	4.70	2.9	—	0.00		
7	0	4.95	—	3.82	0.00	4.92	—	0.00		
8	2.08	0.00	—	4.10	2.00	0.00	—	0.00		
9	4.8	4.95	—	2.30	4.8	4.92	—	0.00		
10	2.63	4.95	—	0.63	2.54	4.92	—	0.00		
11	2.59	4.88	—	2.50	2.53	4.86	—	0.00		
12	4.79	4.95	—	1.28	4.70	0.33	—	0.00		
13	3.26	4.95	—	0.51	3.20	0.33	—	0.00		
14	4.93	0.32	—	1.34	4.81	4.92	—	0.00		
15	0.21	4.72	—	0.00	0.21	4.70	—	0.00		
16	0.00	4.92	—	1.71	4.71	4.92	—	0.00		
17	4.83				4.82					
18	0.00				0.00					
19	4.83				4.82					
20	2.26				2.21					

### Transistor

Ref. No.	Unsquelch			Squelch		
	E	B	C	E	B	C
Q11	0.00	0.00	4.92	0.00	1.41	0.00

### IC

Pin No.	Unsquelch	Squelch
IC2 of 11	0.00	4.88

## 2. Tone Squelch Function

CTCSS Tone: 100Hz, only T-SQL ON, squelch volume must be turned counterclockwise

MIC: Receive (SSG: AF 100Hz, Modulation 700Hz, RF level 1000 $\mu$ V)

Transmit (Unmodulated)

### IC

Pin No.	Receive				Transmit	
	Without Tone		With Tone		IC1002	IC1003
	IC1002	IC1003	IC1002	IC1003		
1	1.98	0.11	1.98	0.07	1.98	1.53
2	2.00	4.70	1.96	4.70	1.96	4.70
3	1.55	4.70	1.52	4.70	1.53	4.70
4	1.98	4.70	1.98	4.70	1.98	4.70
5	1.98	4.70	1.98	4.70	1.98	4.70
6	4.89	4.70	4.89	4.70	4.98	4.70
7	1.98	0.00	1.98	0.00	1.98	0.00
8	0.84	0.00	0.28	0.00	0.40	0.00
9	4.85	0.00	4.58	0.00	4.58	0.00
10	0.00	0.98	0.00	0.98	0.00	0.76
11	0.12	2.23	0.12	2.13	0.12	0.00
12	0.00	2.23	0.00	2.12	0.00	0.75
13	1.98	0.14	1.98	0.09	1.98	0.14
14	1.98	1.58	1.98	1.52	1.98	1.53
15	—	0.00	—	0.00	—	1.53
16	—	4.93	—	4.93	—	4.93

### Transistor

Ref. No.	T-SQL OFF			T-SQL ON		
	E	B	C	E	B	C
Q1004	4.93	4.95	0.00	4.93	0.33	4.89

### 3. DTMF Squelch Function

DTMF Tone: Only D-SQL ON, squelch volume must be turned counterclockwise

MIC: Receive (SSG: AF1 69Hz, AF2 1209Hz, modulation 3.5kHz, RF level 0.25 $\mu$ Vpd)

Transmit (Press button number "1" continuously)

#### Transistor

Ref. No.	Receive						Ref. No.	Transmit					
	D-SQL OFF			D-SQL ON				Normal			With DTMF		
	E	B	C	E	B	C		E	B	C	E	B	C
Q1005	4.93	4.95	0.00	4.92	0.31	4.85	Q5	0.00	0.87	0.15	0.00	1.99	0.03

#### Diode (Receive)

Ref. No.	D-SQL OFF		D-SQL ON	
	A	C	A	C
D1006	0.23	0.00	4.00	3.54

#### IC/PTT PCB (Bandpass Filter)

Pin No.	Receive				Transmit	
	D-SQL OFF		D-SQL ON		Normal	With DTMF
	IC1007	PTT PCB	IC1007	PTT PCB	IC1004	IC1004
1	0.08	0.000	0.00	4.85	4.93	4.93
2	0.08	0.00	0.00	0.00	0.00	4.70
3	0.00	0.00	4.68	2.10	4.90	4.90
4	0.00	—	4.85	0.00	4.90	4.90
5	0.31	2.10	4.03	2.10	0.00	0.00
6	0.17	—	0.00	—	0.02	2.23
7	0.00	—	4.58	—	4.93	1.97
8	0.00	—	0.00	—	0.08	1.95
9	0.00	—	0.00	—	4.70	4.55
10	0.15	—	1.00	—	4.70	4.56
11	0.3	—	0.36	—	4.70	4.49
12	0.24	—	2.02	—	4.70	4.49
13	0.00	—	0.00	—	0.00	0.00
14	0.24	—	4.00	—	0.00	2.04
15	0.08	—	0.00	—	—	—
16	0.20	—	0.17	—	—	—

#### 4 Back Light Function

##### Transistor

Ref. No.	Back Light OFF			Back Light ON		
	E	B	C	E	B	C
Q1001	4.93	4.70	0.05	4.92	0.05	1.42
Q1002	0.00	0.00	0.05	0.00	0.76	1.44
Q1003	0.00	0.05	4.12	0.75	1.42	2.75

##### Diode

Ref. No.	Back Light OFF		Back Light ON	
	A	B	A	C
D1001	5.63	4.12	4.89	2.75
D1002	7.16	5.63	7.10	4.89

#### 5. Sub Board PCB

Function: Normal

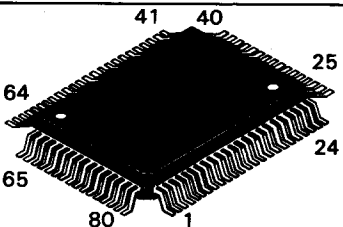
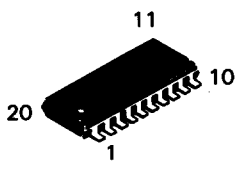
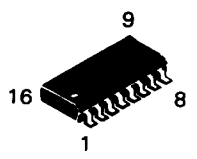
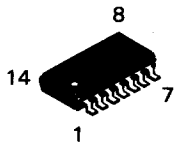
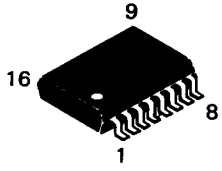
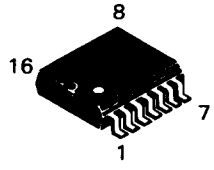
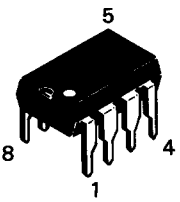
Mic: Receive (Squelch)

Transmit (Unmodulated)

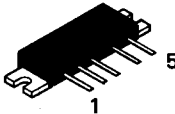
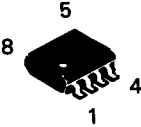
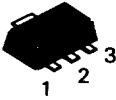
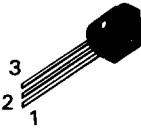
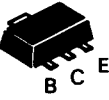
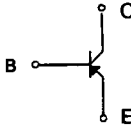
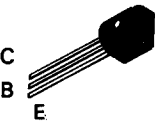
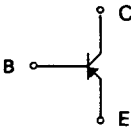

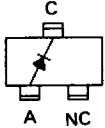

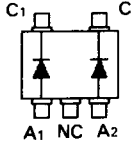

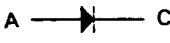

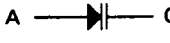
##### Sub PCB

Pin No.	Receive							Transmit						
	APC	Audio		HPF	Level	MIC	VCO	APC		Audio	HPF	Level	MIC	VCO
		UnSQ.	SQ					High	Low					
1	0.00	0.00	0.00	2.24	4.89	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.12	0.00
2	020	0.00	0.00	0.00	5.01	0.00	4.78	6.31	4.30	0.00	0.00	0.00	1.93	4.69
3	6.94	0.00	0.00	4.95	4.85	0.00	0.00	6.49	6.65	0.00	4.93	4.84	1.93	0.00
4	0.00	0.00	4.88	2.48	6.98	0.00	0.00	0.30	0.94	4.74	2.47	6.51	0.00	4.70
5	0.00	6.36	0.00	2.47	0.00	0.00	0.00	4.79	4.79	0.00	2.47	0.00	4.89	0.00
6	0.00	6.95	7.14	0.00	1.80	0.00	3.20	0.00	0.00	6.65	0.00	0.00	0.00	2.87
7	-	3.52	1.30	-	0.00	0.00	4.91	-	-	1.29	-	1.00	0.00	4.81
8	-	-	-	-	0.00	0.00	0.00	-	-	-	-	-	0.68	0.00
9	-	-	-	-	4.8	-	-	-	-	-	-	4.8	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-

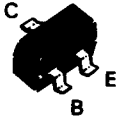
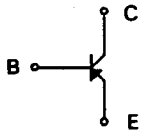
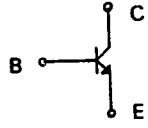
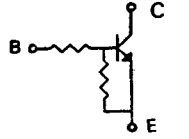
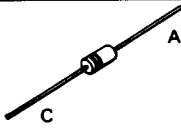

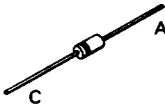

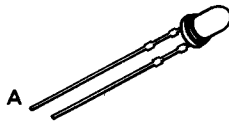
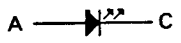
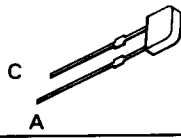
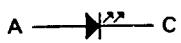
# SEMICONDUCTOR LEAD IDENTIFICATION

Base Diagram	Manufacturer's No.	Schematic Ref No.	
	HD404808FS	IC1006	CPU Mask ROM
	MC145191F	IC1	PLL
	MC14094BD	IC2	Shift Register
	MC3371DR2	IC4	IF
	LM339M	IC301	Quad Comparator
	MC74HC4078D	IC1008	8 Input Nor Gate
	LM2902	IC101, IC401, IC501	Quad OP Amp
	KS58015	IC1004	DTMF Generator
	MC142100DW	IC1003	Cross Point Switch
	MC145436DW	IC1007	DTMF Receiver
	MF6CWM-100	IC1002	Switched Capacitor
	LM386N3	IC601	Audio Amp

B: Base C: Collector D: Drain  
 E: Emitter G: Gate S: Source

Base Diagram	Manufacturer's No.	Schematic Ref. No.	
	M57797MA	IC5	PWR MDL
	KIA393F	IC1009	OP Amp
 <p>1: OUT 2: V<sub>DD</sub> 3: V<sub>SS</sub></p>	S8054ALR-LN (LN)	IC1005	Voltage Detector
 <p>1: OUT 2: GND 3: IN</p>	TK11650	IC3, IC1001	5V Regulator
	KTA1663 (HO)	Q902	
	LSP 966	Q701	
	MMBV3401 (4D)	D7, D8	
	KDS193S (F3)	D901, D1001, D1003, D1006	
	RB471E (D3G)	D1002, D1004, D1005 D1007, D1008	
	1SS241 (TY)	D1, D6, D203	
	1SV153	D201, D202	

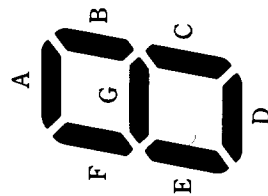
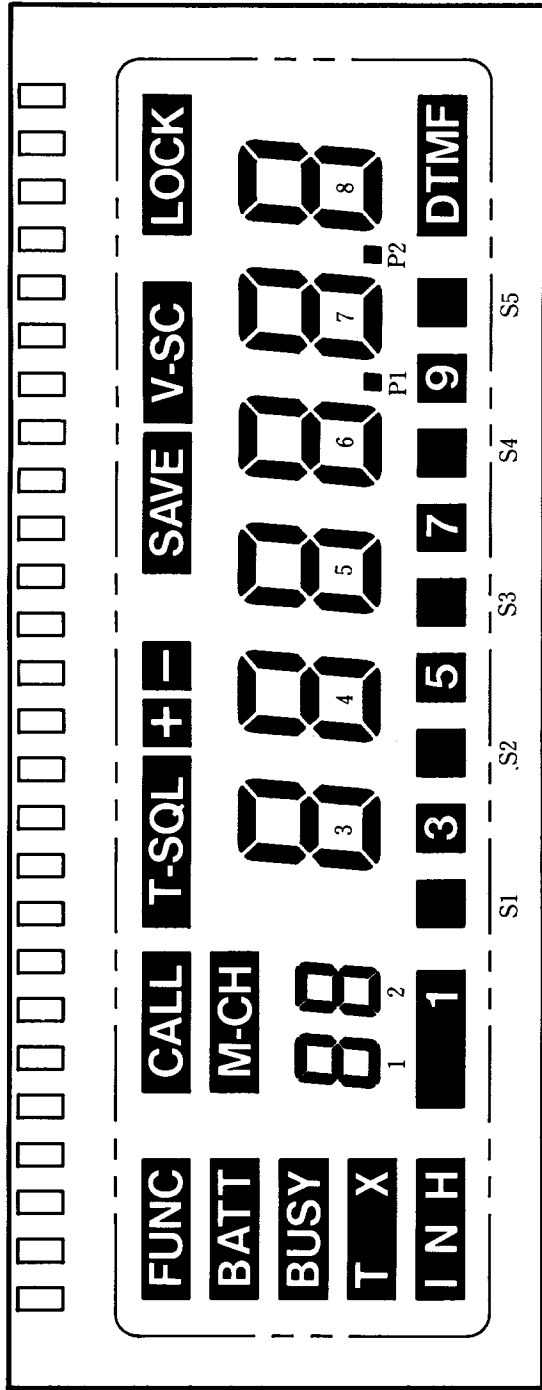
A: Anode B: Cathode  
 NC: No Connection

Base Diagram	Manufacturer's No	Schematic Ref. No	
	KTA1504S (ASG)	Q13, Q601, Q901, Q903	
	BCX18	Q1	
	2SC3120(HB)	Q4	
	MMBC1321 (Q4)	Q15	
	2SC3606	Q2, Q3, Q204	
	BFR92A	Q201, Q202	
	KTC3875S (ALG)	Q14, Q702, Q703, Q704, Q1002	
	KTN2222S (ZB)	Q1003	
	BC848 (1L)	Q205	
	KRA110S (PK)	Q6, Q7, Q12, Q1001, Q1004, Q1005	
KRC110S (NK)	Q5, Q11, Q203		
KRC104S (ND)	Q602, Q603, Q1006		
	1SS97	D2	
	1N5819	D4, D5	
	KLR124	D902	
	SLP-378H	LED1001, LED1002	

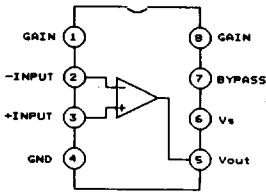


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
com1	1	-	-	V-SC	T X	-	1A	-	2A	-	3A	-	4A	-	5A	-	6A	-	7A	-	8A	-	com1	-	-	-
com2 s1	3	LOCK	+	SAVE	BUSY	M CH	1F	1B	2F	2B	3F	3B	4F	4B	5F	5B	6F	6B	7F	7B	8F	8B	-	com2	-	-
com3 s2	5	DTMF	-	P1	BATT	INH	1G	1C	2G	2C	3G	3C	4G	4C	5G	5C	6G	6C	7G	7C	8G	8C	-	-	com3	-
com4 s3	7	9	T SQL	P2	FUNC	CALL	1E	1D	2E	2D	3E	3D	4E	4D	5E	5D	6E	6D	7E	7D	8E	8D	-	-	-	com4

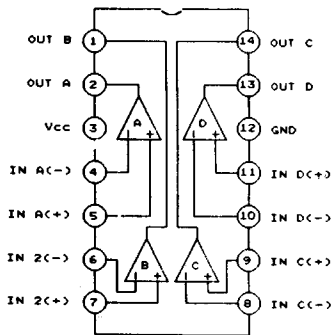
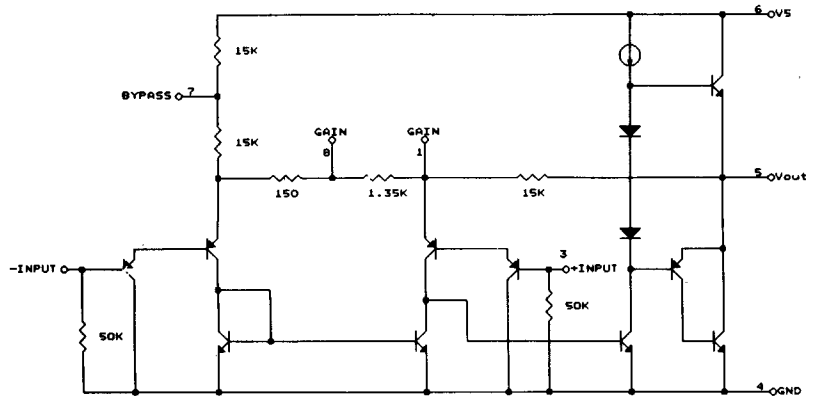
26



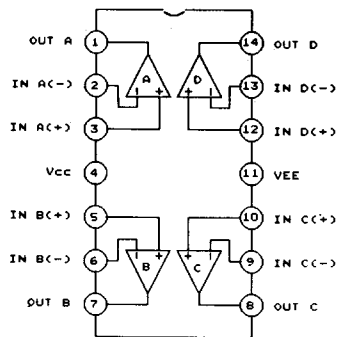
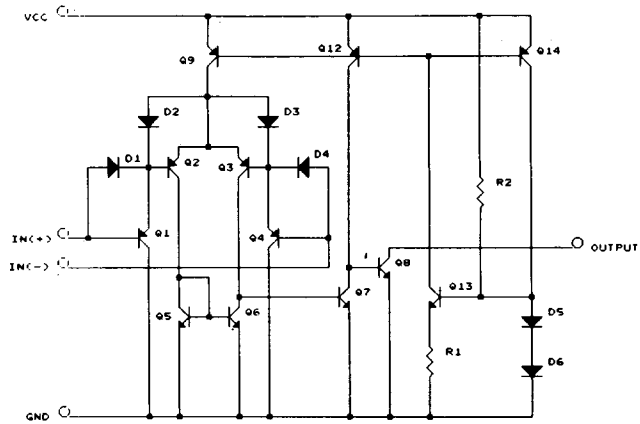
# IC INTERNAL CONNECTION



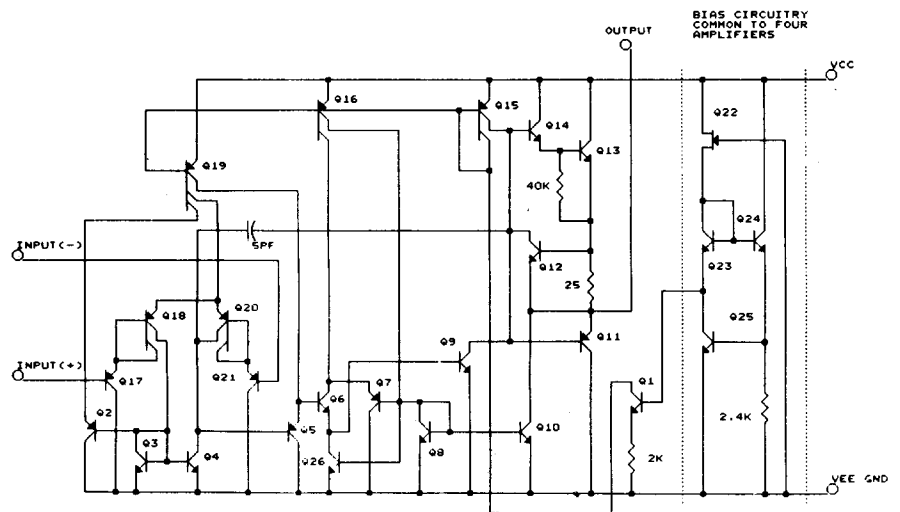
**LM386-N3**

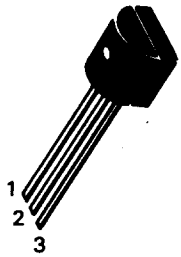


**LM339M**



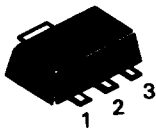
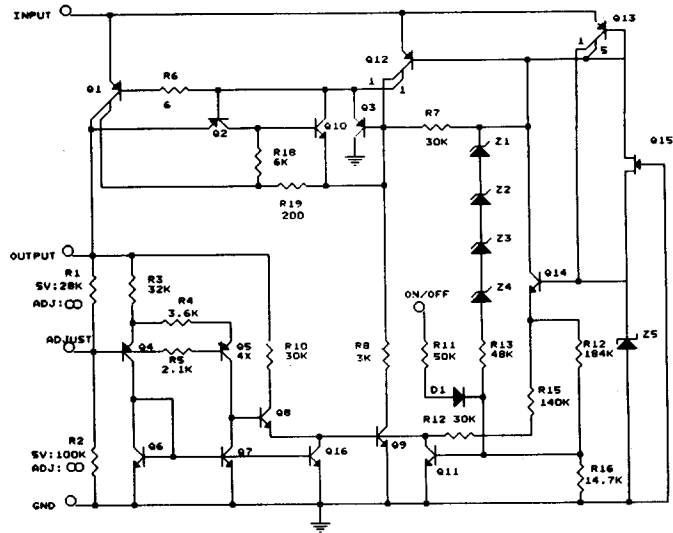
**LM2902M**





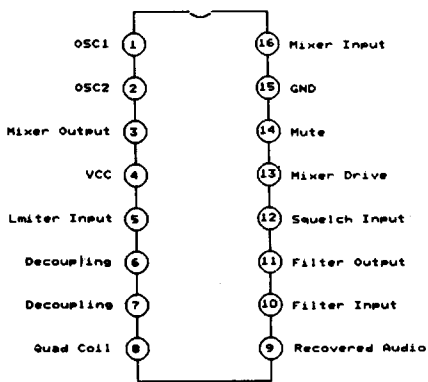
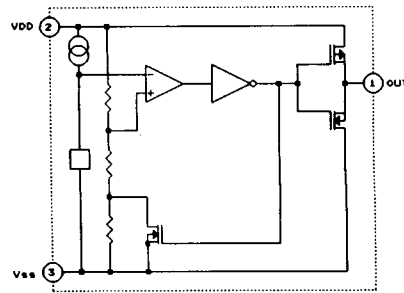
- 1: OUT
- 2: GND
- 3: IN

**TK11650**

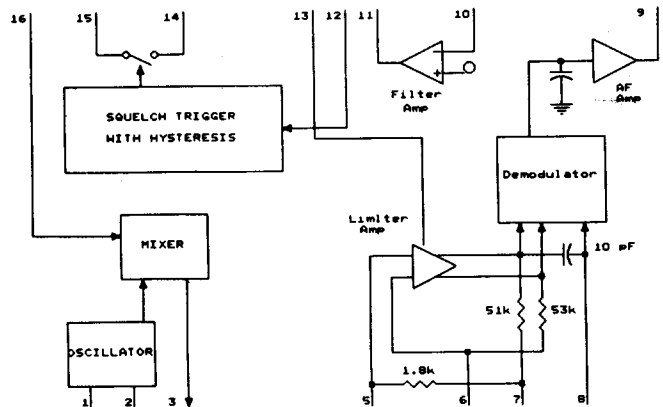


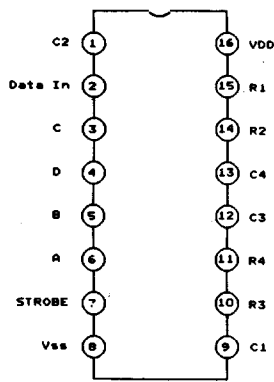
- 1: OUT
- 2: V<sub>DD</sub>
- 3: V<sub>SS</sub>

**S80554ALR-LN**

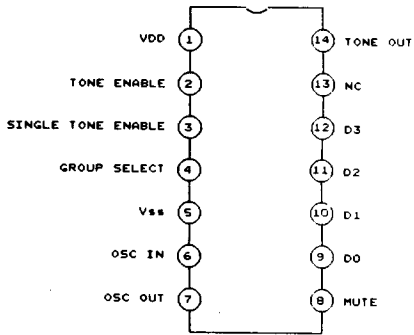
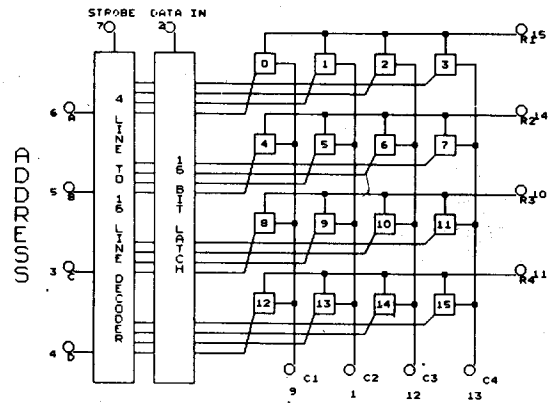


**MC3371DR2**

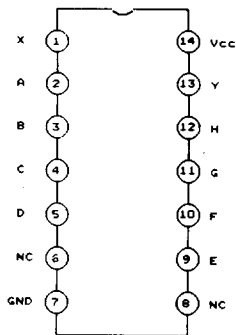
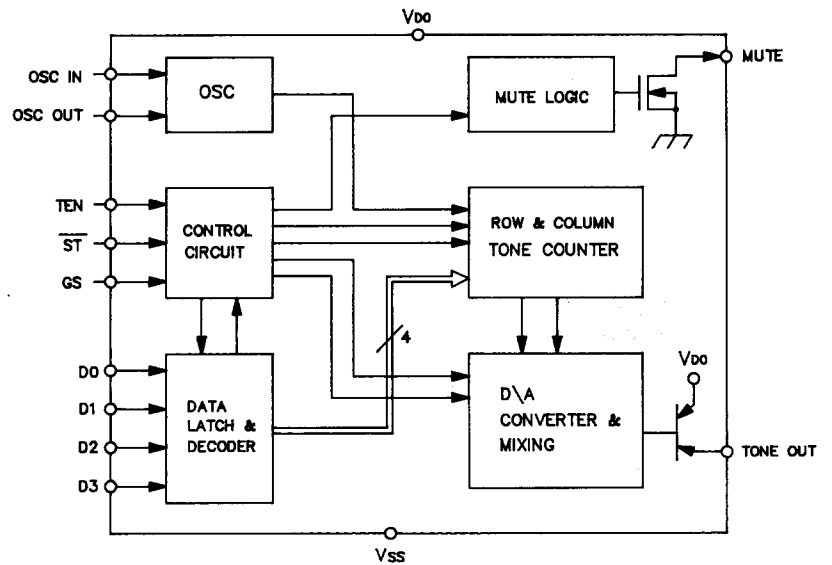




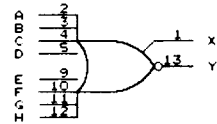
**MC142100DW**



**KS58015**

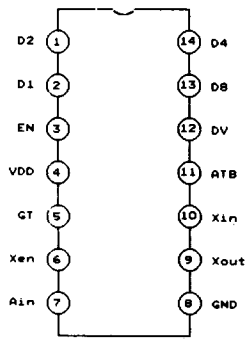


**MC74HC4078D**

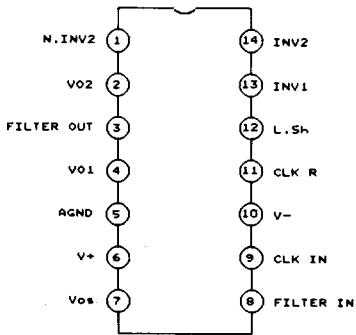
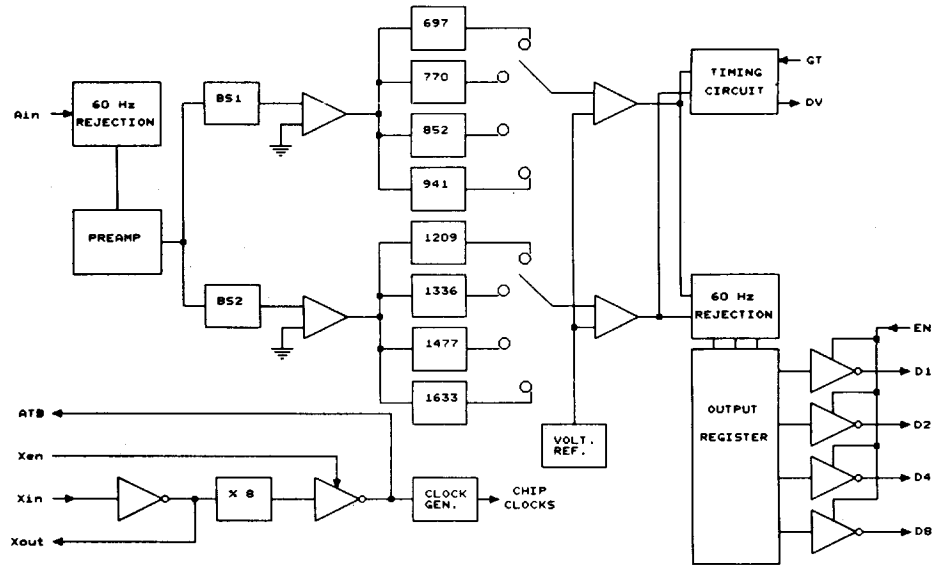


$Y = A + B + C + D + E + F + G + H$   
 $X = A + B + C + D + E + F + G + H$

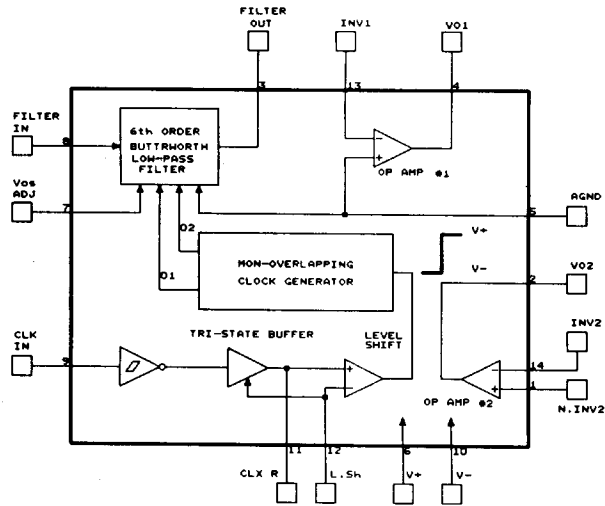
PIN 14 = Vcc  
 PIN 7 = GND  
 PINS 6, 8 = NO CONNECTION



**MC145436DW**

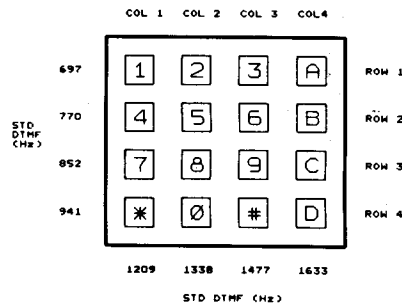


**MF6CWM-100**

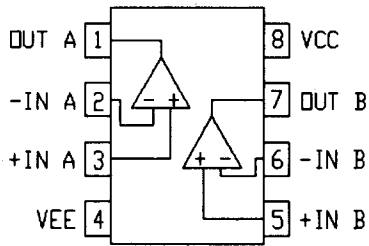


**Hexadecimal Codes**

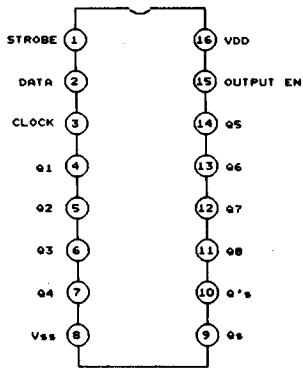
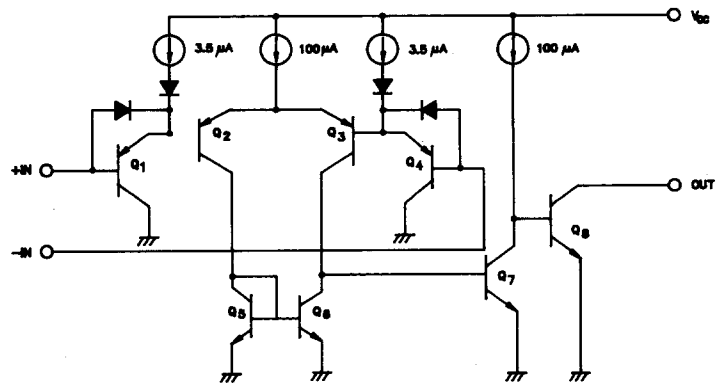
DIGIT	OUTPUT CODE			
	D8	D4	D2	D1
1	0	0	0	0
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
0	1	0	1	0
.	1	0	1	1
*	1	1	0	0
A	1	1	1	0
B	1	1	1	0
C	1	1	1	1
D	0	0	0	0



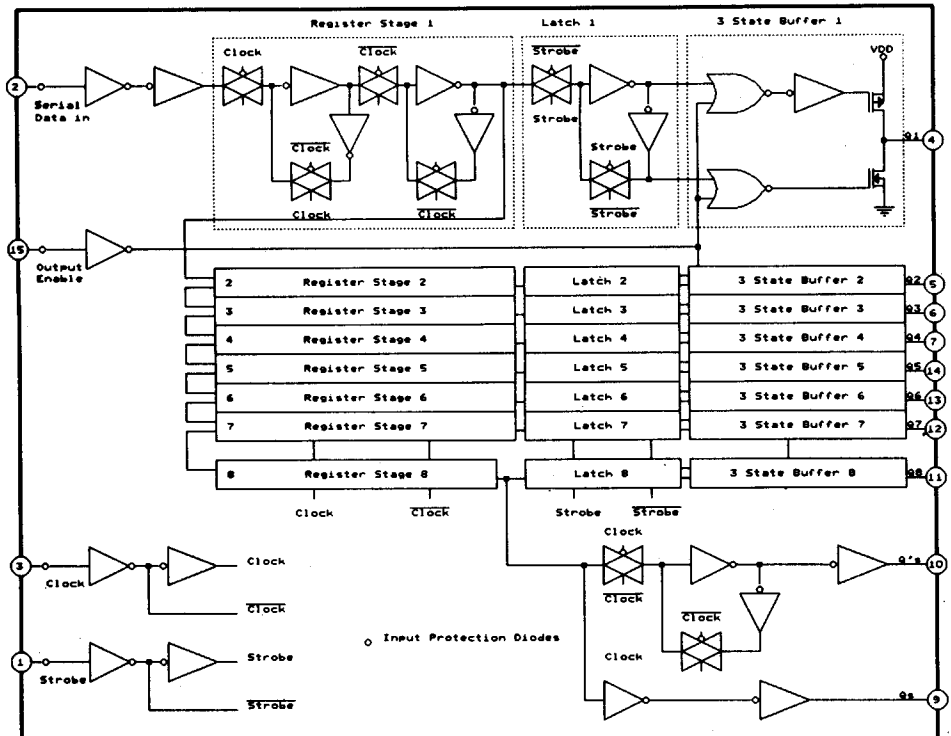
**4x4 Keyboard Matrix**

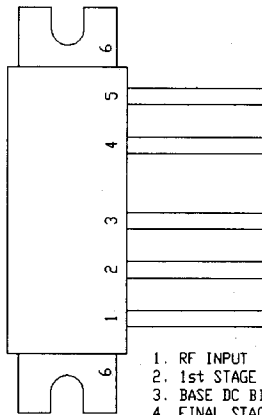


**KIA393F**



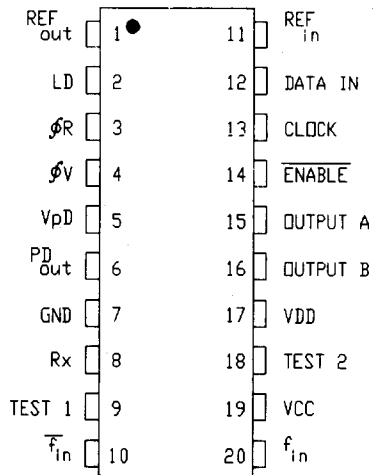
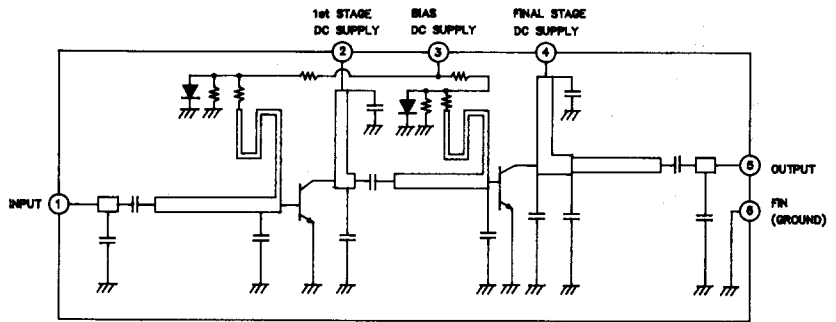
**MC14094BD**



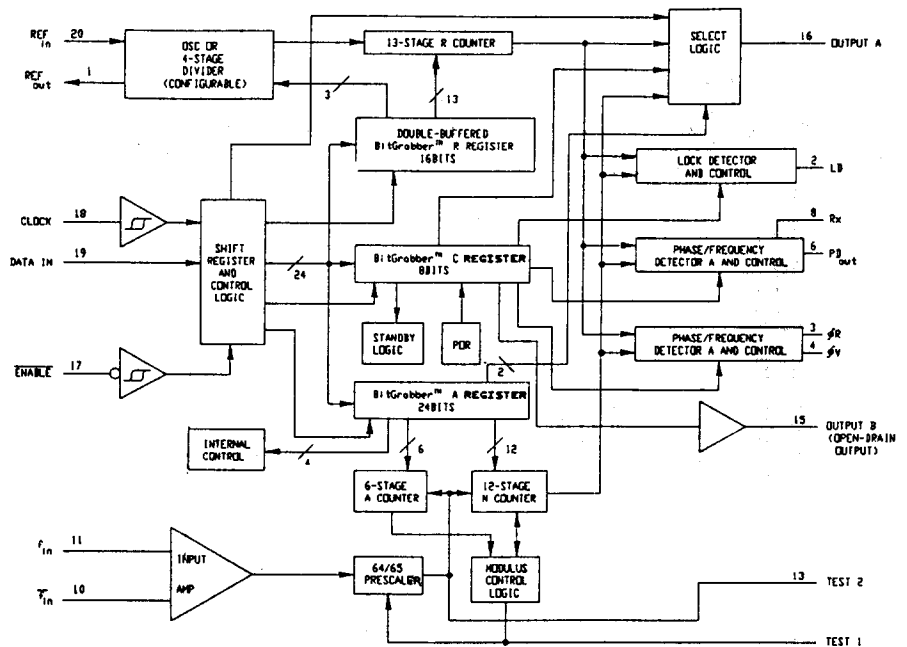


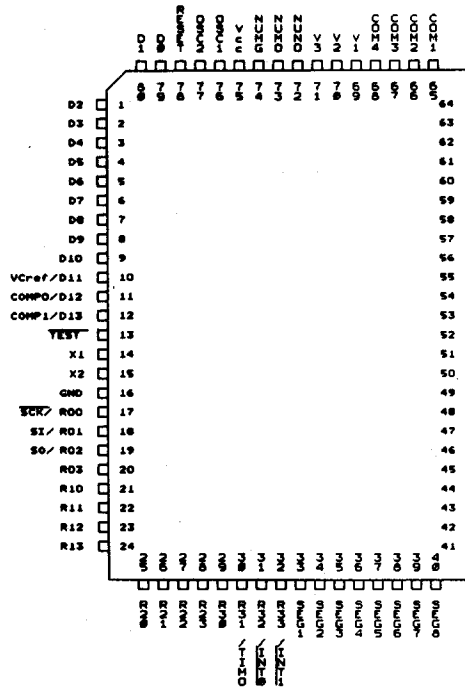
1. RF INPUT
2. 1st STAGE DC SUPPLY
3. BASE DC BIAS
4. FINAL STAGE DC SUPPLY
5. RF OUTPUT
6. FIN (GROUND)

### M57797MA



### MC145191F

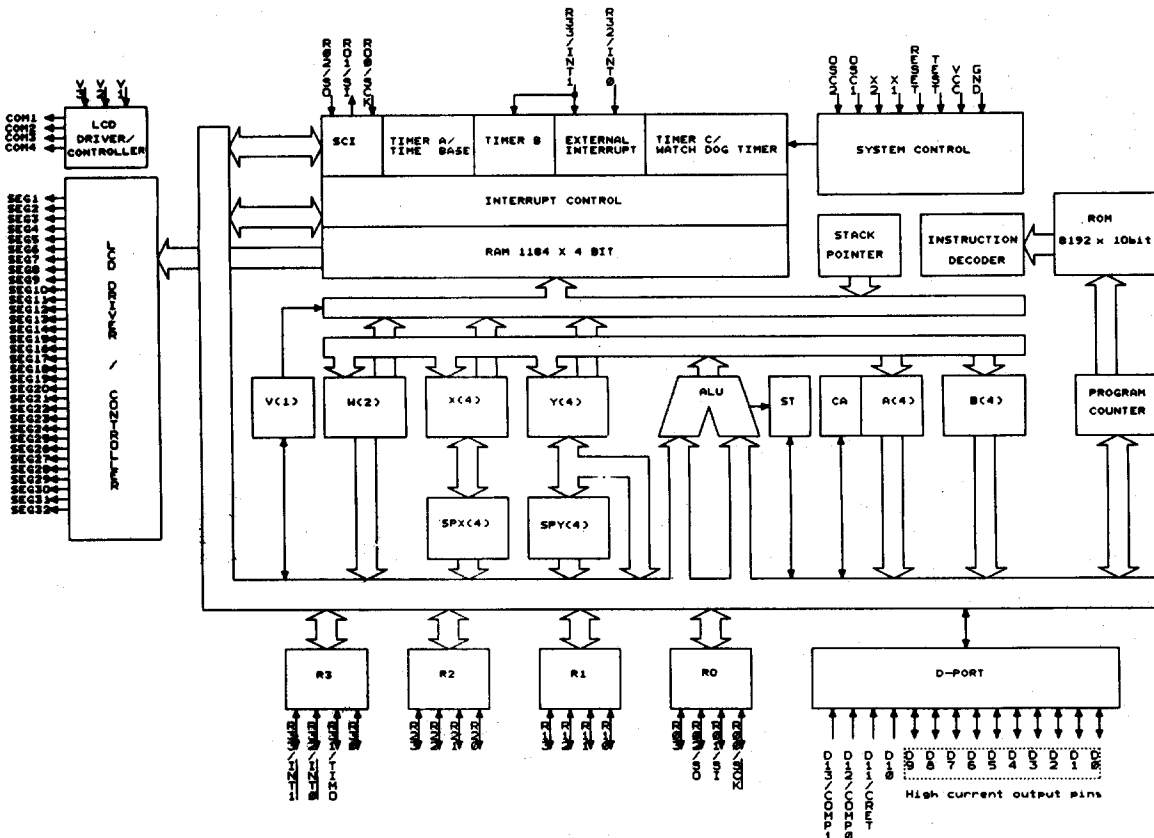




### HD404808FS

I : INPUT PIN  
 O : OUTPUT PIN  
 NUMO : OPEN  
 NUMG : GND

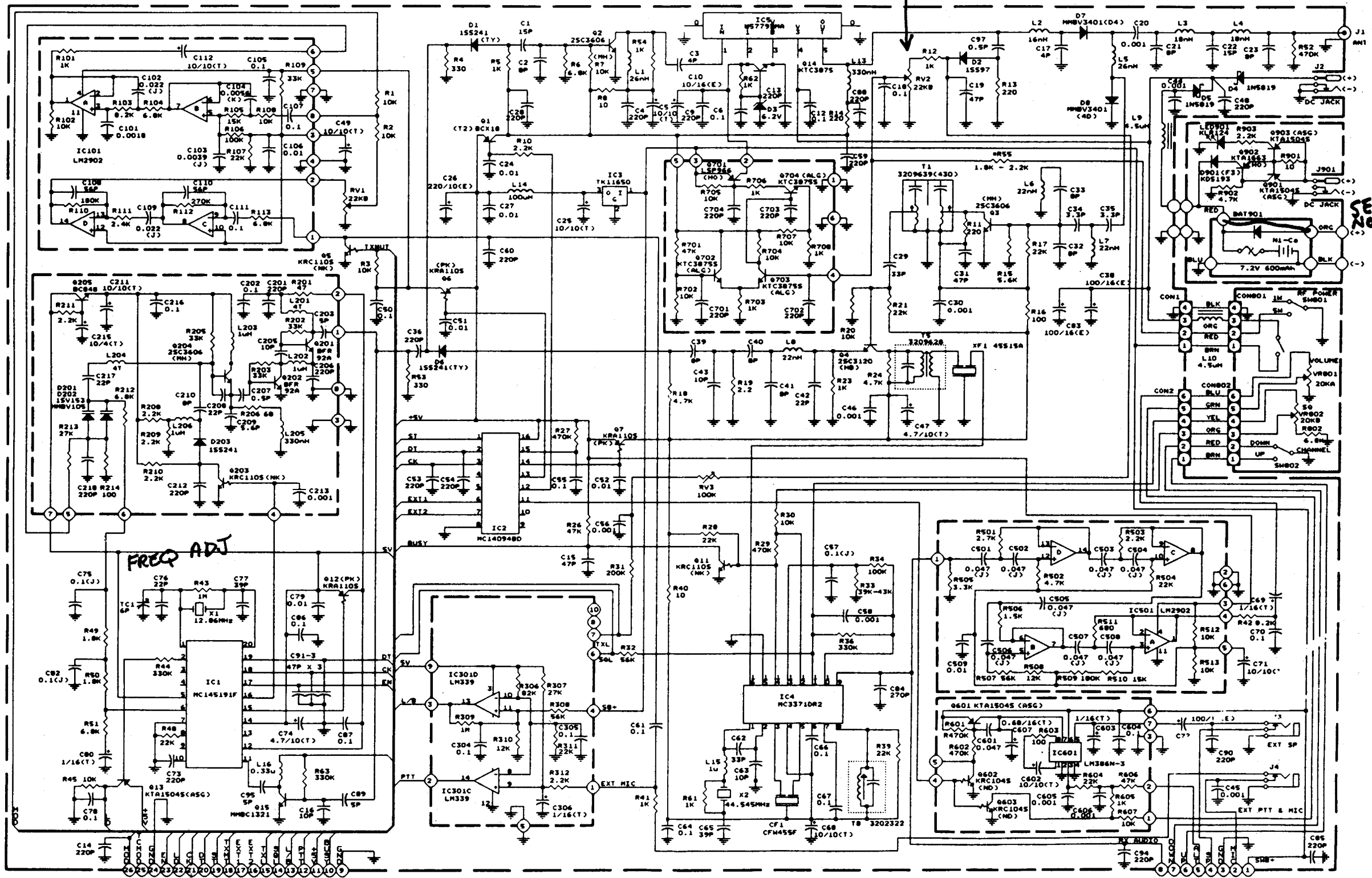
PIN NO.	PIN NAME	I/O	PIN NO.	PIN NAME	I/O
1	D2	I/O	41	SEG9	O
2	D3	I/O	42	SEG10	O
3	D4	I/O	43	SEG11	O
4	D5	I/O	44	SEG12	O
5	D6	I/O	45	SEG13	O
6	D7	I/O	46	SEG14	O
7	D8	I/O	47	SEG15	O
8	D9	I/O	48	SEG16	O
9	D10	I	49	SEG17	O
10	D11 /VCref		50	SEG18	O
11	D12 /COMPO		51	SEG19	O
12	D13 /COMP1		52	SEG20	O
13	YES		53	SEG21	O
14	X1		54	SEG22	O
15	X2	O	55	SEG23	O
16	GND		56	SEG24	O
17	RO0 /SCK	I/O	57	SEG25	O
18	RO1 /SI	I/O	58	SEG26	O
19	RO2 /SO	I/O	59	SEG27	O
20	RO3	I/O	60	SEG28	O
21	R10	I/O	61	SEG29	O
22	R11	I/O	62	SEG30	O
23	R12	I/O	63	SEG31	O
24	R13	I/O	64	SEG32	O
25	R20	I/O	65	COM1	O
26	R21	I/O	66	COM2	O
27	R22	I/O	67	COM3	O
28	R23	I/O	68	COM4	O
29	R30	I/O	69	V1	
30	R31 /TIM0	I/O	70	V2	
31	R32 /INT0	I/O	71	V3	
32	R33 /INT1	I/O	72	NUM0	
33	SEG1	O	73	NUM0	
34	SEG2	O	74	NUMG	
35	SEG3	O	75	Vcc	
36	SEG4	O	76	OSC1	I
37	SEG5	O	77	OSC2	O
38	SEG6	O	78	RESET	I
39	SEG7	O	79	DO	I/O
40	SEG8	O	80	D1	I/O





# SCHEMATIC DIAGRAMS

Cat. No.: 19-1140



NOTE: BATTERY IS 6 CELLS,  
 RATED 7.2VDC @ 600MAH  
 JUMPER FROM RED TO ORANGE LEAD  
 70  
 (BYPASSING THE DIODE) INSTALLED 30DEC99

