

# TH-315A

## SERVICE MANUAL

# KENWOOD

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## CIRCUIT DESCRIPTION

### Receiver section

The basic construction of the receiver section is of the double-superheterodyne system using the first IF of 16.9 MHz and second IF of 455kHz.

The signal input to the antenna is HF amplified by Q6 : 2SC3356 and Q7 : 2SC2714 which are connected in cascade, and supplied to the BPF of L15 to L17. The output from the BPF is supplied to first mixer Q8 : 2SK210(GR) to be mixed with the first local oscillator (PLL) output signal. The first mixer output is supplied through a 16.9 MHz MCF, amplified by Q9 : 2SC2714(O), and input to IC1 : TA7761P of the IF unit as the first IF signal. The first IF signal is mixed with the 16.445MHz signal from the second local oscillator, and covered into the 455kHz second IF signal. The 455kHz second IF signal is supplied through ceramic filter CF1, amplified by an internal amp, and detected.

The detected signal is sent through the AF VOL, amplified by IC2 : BA526, and sent to the speaker.

Item	Rating
Noninal center frequency (fo)	16.9MHz
Pass bandwidth	fo ± 7.5kHz or more at 3dB
Attenuation bandwidth	fo ± 25kHz or more at 40dB
Guaranteed attenuation	70dB or more within fo ± 1MHz Spurious : 40dB or more at fo ~ fo + 500kHz.
Ripple	1dB or less
Insertion loss	2dB or less
Terminal impedance	1.8kΩ//0pF

Table 1 MCF (L71-0276-05)(RF unit XF1,2)

Item	Rating
Center frequency of 6dB bandwidth (fo)	455kHz ± 1.5kHz
6dB bandwidth	± 7.5kHz or more
40dB bandwidth	± 15kHz or less
Ripple	1.5dB or less (455 ± 5kHz)
Guaranteed attenuation	27dB or more within fo ± 100kHz
Insertion loss	6dB or less at 455kHz
Terminal impedance	1.5kΩ

Table 2 Ceramic filter (L72-0335-05) (IF unit CF1)

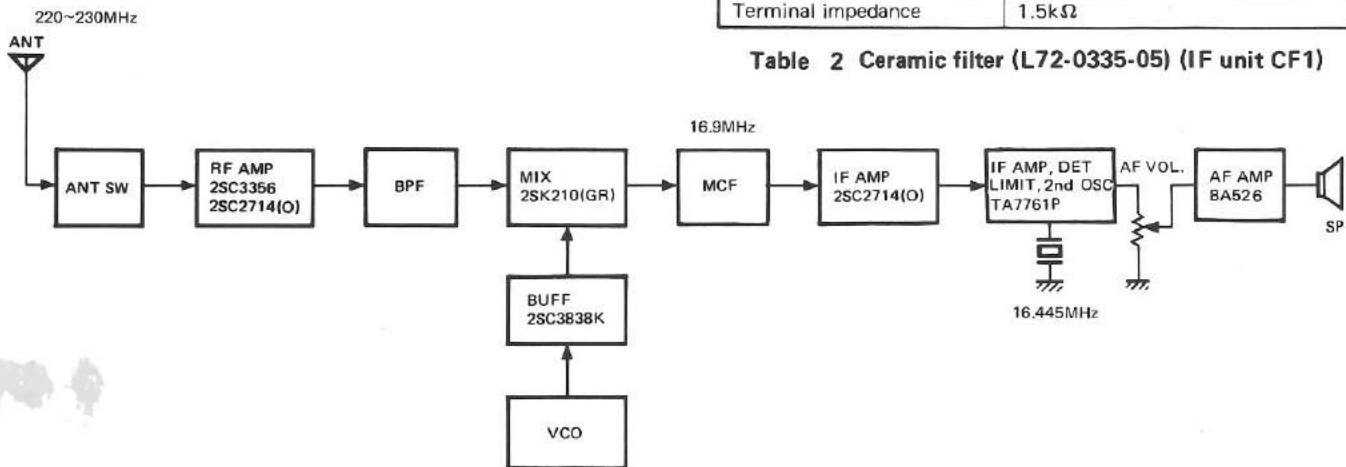


Fig. 1 RX section block diagram

### Transmitter section

The audio signal from the MIC is amplified at sub-unit (X59-3090-10) (microphone amp) of the IF unit, then sent to sub-unit (L78-0042-08) (VCO) of the RF unit in order to apply direct modulation to the VCO utilizing the capacitance between the electrodes of D1 : DAN235K.

The VCO output is amplified by Q2 : 2SC3838K(N,P) and Q3 : 2SC2407, supplied through power-controller pin diode D3 : 1SV172, and power-amplified by final IC1 : M67723.

The transmission output from IC1 is sent through low pass filter and transmission/reception switching diode D5 : MI303, and supplied to the ANT terminal.

A part of the output is detected by D8 and D9 : HSM88AS. It is used by Q4 : 2SA1313(Y) and Q5 : FMW1 to control the current flowing to D3 and to apply APC by varying the power driving IC1. The power adjustment is performed by VR1 and VR2 on the IF unit.

## CIRCUIT DESCRIPTION

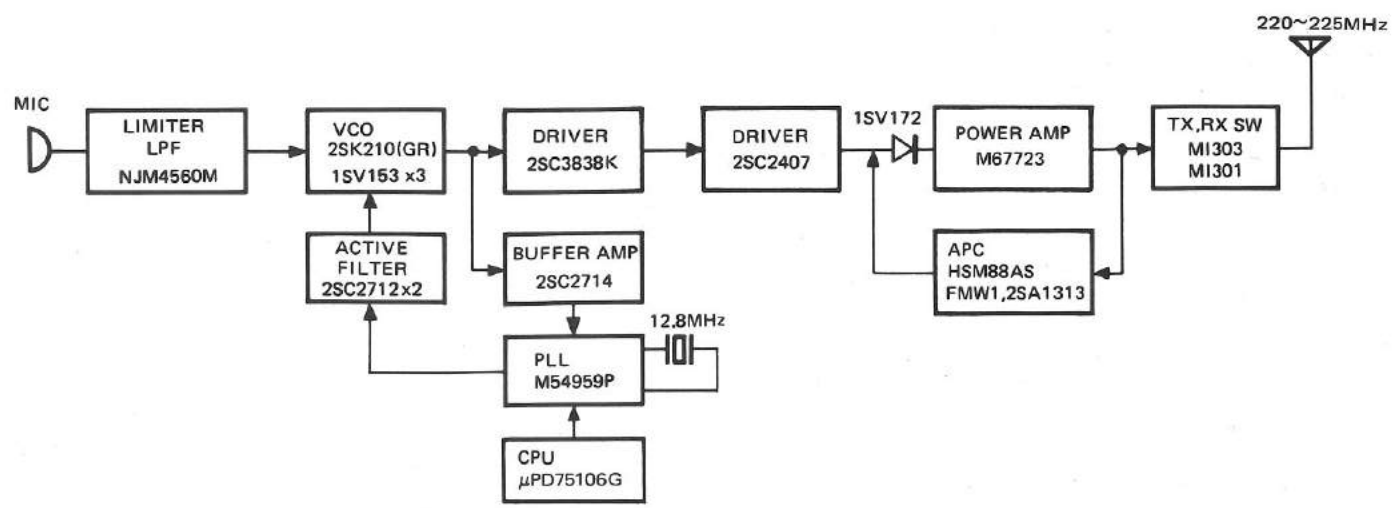


Fig. 2 TX section block diagram

### PLL unit

The VCOs are provided independently for transmission and reception, and use Colpitts oscillator circuits of Q1 and Q2 : 2SK210(GR). The two VCOs are switched by switching Q14 : FMG4 using the serial data sent from the microprocessor PLL control IC2 : M54959P.

The VCO output is distributed to the transmitter, receiver and PLL. The signal supplied to the PLL circuit is input to IC2 via the buffer circuit of Q1 : 2SC2714(O). The VCO output, which is input to IC2, is divided with the dividing ratio set by the serial data from the microprocessor. On the other hand, its phase is compared with that of a 5kHz signal obtained by dividing X1 : 12.8MHz, and the result is output from pin 9 of IC2. The phase comparison output passes through the active filter of Q12 of Q13 : 2SC2712(GR) and controls the VCO.

If the PLL is unlocked during transmission and the UL line from the RF unit goes high (HI), the microprocessor turns the TX line to low (LO) and returns to the transmission mode preventing abnormal reception.

### Power supply circuit

The TH-315 provides the following regulated/unregulated voltages;

- T5 ..... 5V DC in transmit
- R5 ..... 5V DC in receive
- C5 ..... 5V DC constant
- M5 ..... 5V DC for the microphone
- VDD ..... 5V DC for microprocessor bias
- KEY ..... Key matrix voltage
- CB ..... Battery voltage

The C5 constant voltage circuit utilizes three-pin regulators IC5 : LP2950CZ, Q14 : 2SA1358Y and Q15 : FMW1.

The T5 circuit consisting of Q13 : 2SA1313(Y) and Q16 : DTC114YK is controlled by the TX line from the microprocessor.

The R5 circuit, Q11 : DTA143ZK and Q12 : DTA144EK is controlled by the output of the T5 circuit.

The M5 and KEY lines are directly controlled by three-pin regulator IC5.

VDD utilizes the output of the three-pin regulator IC4 : LP2950CZ to provide microprocessor power. When IC4 is OFF, D6 : 1SS184 causes the microprocessor to be powered from the backup battery, B1.

Since the microprocessor must synthesize TTP information and sub audible tone information the clock frequency is higher than the clock in the TH-205. Therefore, 5V is about 0.7V DC higher in the TH-215, by putting the GND terminal of IC4 higher at D7 : 1SS226.

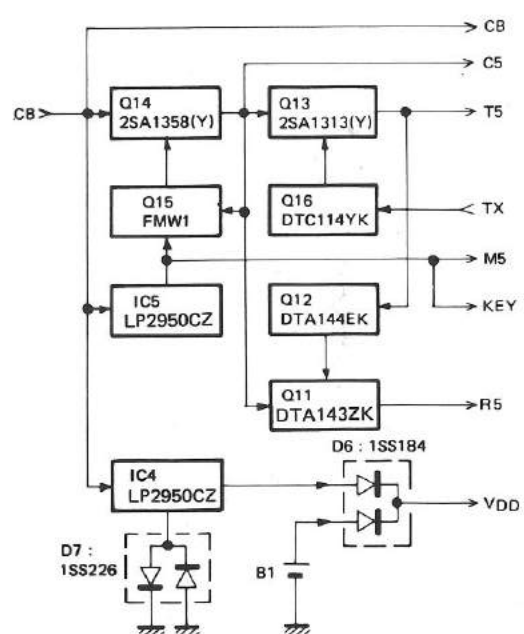


Fig. 3 Power supply circuit

## CIRCUIT DESCRIPTION

### Microprocessor and its peripheral circuits

The TH-315 is designed for multiple functions and has low power consumption, thanks to its 4 bit single-chip microprocessor (IC1 :  $\mu$ PD75106G-524-1B in the control section) and LCD driver (IC2, a  $\mu$ PD7225G in the Case ass'y).

#### • Backup circuits

If the CB voltage drops to approximately 5V, pin 1 of IC3 : S-8045HN in the IF unit goes "L" and pin 44 of the microprocessor goes "L". This places the microprocessor in the backup mode. If the CB voltage returns to normal, pin 44 of the microprocessor goes "H" and places the microprocessor back in the normal operating mode. This causes a differentiating circuit to apply a reset pulse to pin 7 of the microprocessor.

Normally, the microprocessor can be reset by grounding pin 7 or pin 44. However, when the microprocessor lithium backup battery fails or when a new battery is installed the microprocessor must be reset by applying a pulse to pin 7.

Pin 44 is used to reset the microprocessor when normal

reset is impossible, due to low input voltage or a short power outage. If this happens the microprocessors RAM contents will be maintained by the lithium battery.

#### • Squelch circuit

Incoming signals are detected by IC1 : TA7761P (in the IF section) then amplified, rectified, and smoothed by the filter formed by IC1 and Q2 : 2SC2712(GR). The squelch control (SQL VOL.) sets the control voltage on Q1 : 2SC2712(GR). When Q1 is ON, the incoming receive signal is applied to the SQ port (pin 36) of the microprocessor.

When a signal is received, port SQ goes "H" and the BUSY indicator turns ON, in the LCD. At the same time, port AFC (pin 39 of the microprocessor) become "L" and Q6 thru Q8 (Q6 : FMG2, Q7 : 2SC2712(GR), Q8 : 2SA1241Y) of the IF unit, apply power to IC2 and Q6. When power is supplied to IC2, squelch is disabled. Pushing the MONITOR button places the SQ line "H" and the AFC line "L", this also opens squelch.

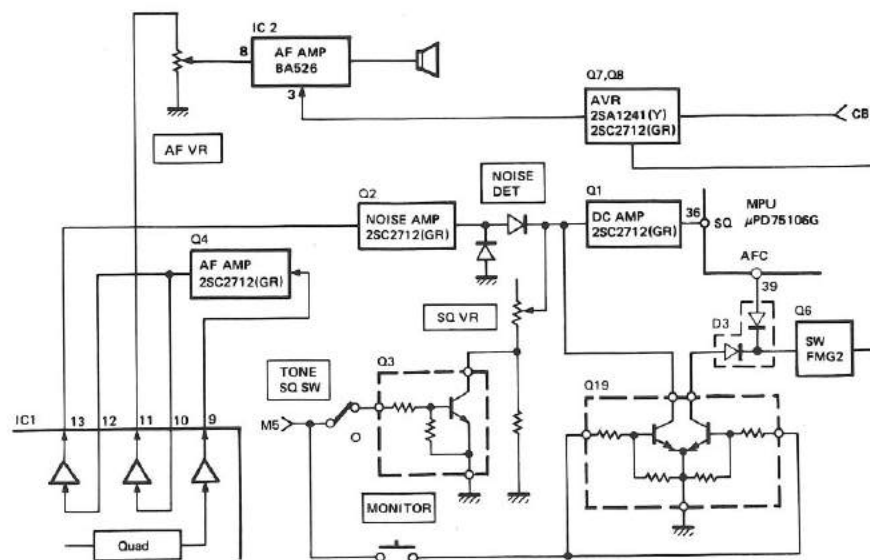


Fig. 4 Squelch circuit

#### • Sub-tone and touch tone signals.

Sub audible tone frequencies and Touch Tone Pad frequencies are generated by the microprocessor in the TH-315. Since sub audible tones are a single tone the sine wave is produced from 7-bit digital data supplied by the microprocessor. Digital to analog conversion (D/A) is performed

by weighted resistor array R18.

Touch tone signals are a two frequency signal produced by combining two 7-bit sine waves to an 8-bit signal. Digital to analog conversion is performed by weighted resistor array R10 for this function.

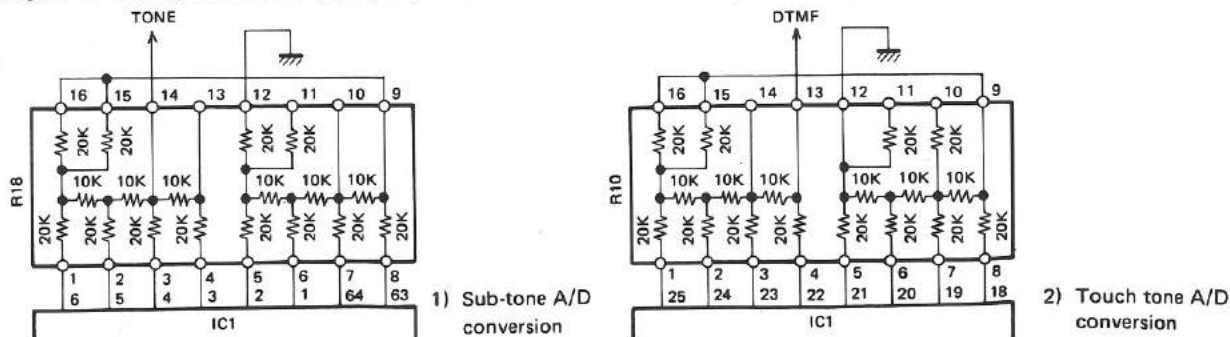


Fig. 5 Sub-tone and touch-tone signals

## CIRCUIT DESCRIPTION/SEMICONDUCTOR DATA

### ● Battery power save circuit

The TH-315 provides several battery saver modes to conserve on battery power. These modes function during the receive mode and not the transmit mode.

#### 1) Save mode

In this mode the radio will activate the battery power save circuit 2 seconds after the squelch closes.

#### 2) Auto save mode

In this mode the radio will activate the battery power save circuit 1 minute after the last key operation during the receive mode.

To select the desired battery saver mode press the **[SAVE]** key. Each time the key is depressed you will step thru the various modes, i.e. for SAVE to AUTO SAVE to OFF and back to SAVE etc. The appropriate indicator will light in the display to remind you which circuit is

active. When no indicator is on the battery power save circuit is OFF.

### 3) Power save ratio selection

In addition to the two different activation modes the TH-315 allows you to specify the actual length of time the receiver section shuts down. To alter this rate press the **[F]** and then the **[SAVE]** key. The display will show the time the radio will be operating at reduced power levels.

During battery saver operation the SAVE line (pin 37) of the microprocessor repeatedly cycles between a logic "H" : High and "L" : Low which turns C5 and R5 ON and OFF. The VDD, KEY and M5 lines are not affected by these circuits and remain active. The ON/OFF interval is adjustable between 1 and 9 units, with each unit equalling about 200msec.

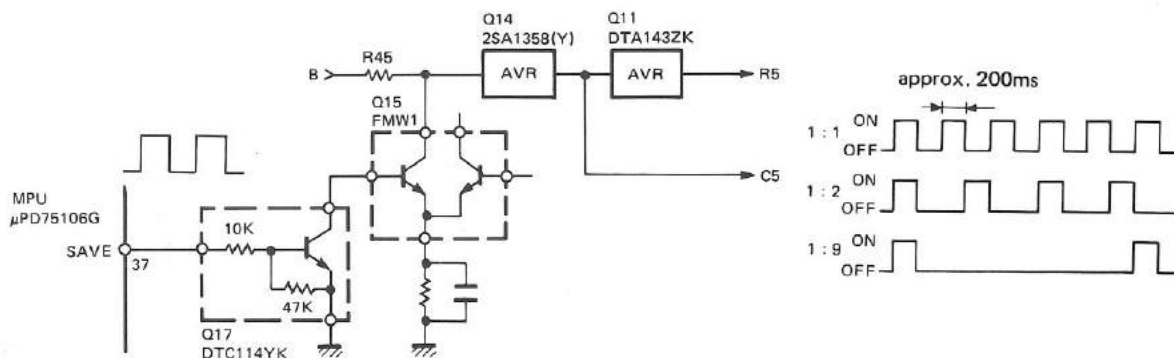
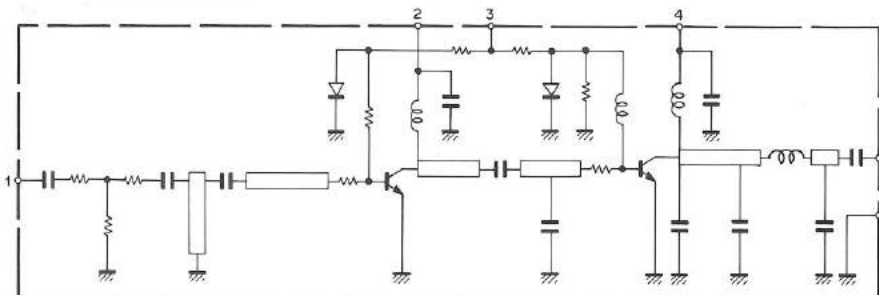


Fig. 6 Battery power save circuit

### RF POWER AMP M67723(RF UNIT IC1)

#### ● Equivalent circuit



- 1: INPUT
- 2: PRE-DRIVE+B
- 3: BIAS+B
- 4: FINAL+B
- 5: OUTPUT
- 6: GND

#### ● Electrical characteristic

Item	Symbol	Rating			Unit
		Min	Max	Typ	
Output power	P <sub>o</sub>	7	8	—	W
Total efficiency	η <sub>T</sub>	45	50	—	%
2nd spurious		—	—	-20	dB
Spurious after 3rd		—	—	-30	dB
Input SWR	ρ <sub>in</sub>	—	2.0	2.5	—
Output SWR	ρ <sub>out</sub>	—	1.5	—	—

T<sub>a</sub> = 25°C, V<sub>cc</sub> = 12.5V, V<sub>BB</sub> = 5V, f = 220~225MHz,  
P<sub>in</sub> = 20mW, Z<sub>G</sub> = Z<sub>L</sub> = 50Ω

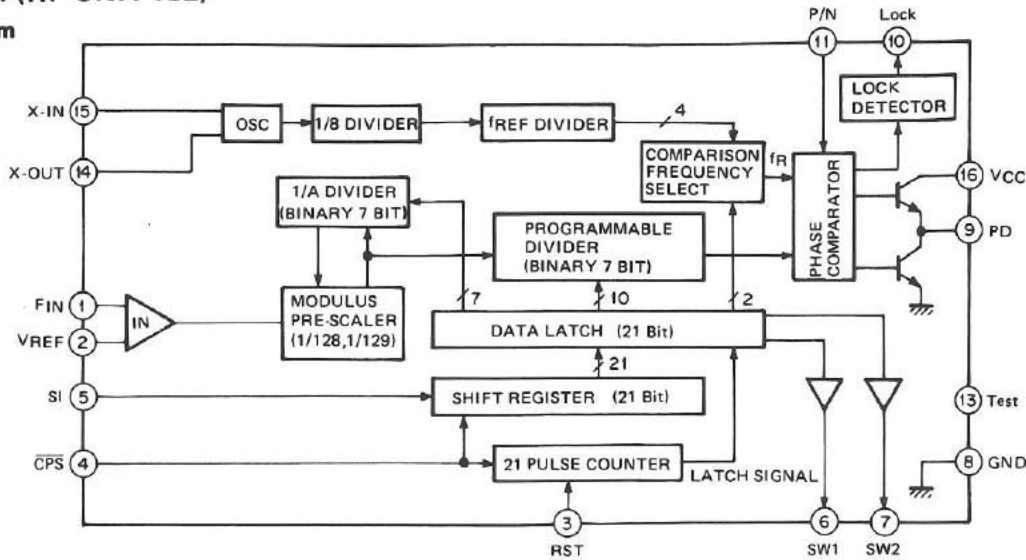
#### ● Maximum rating

Item	Symbol	T <sub>c</sub> (°C)	Condition	Rating	Unit
Operating voltage	V <sub>cc</sub>	25		16	V
Bias voltage	V <sub>BB</sub>	25		6	V
Current consumption	I <sub>cc</sub>	25		4	A
Input power	P <sub>in</sub>	25	V <sub>cc1</sub> ≤ 12.5V, Z <sub>G</sub> = 50Ω	40	mW
Output power	P <sub>o</sub>	25	Z <sub>L</sub> = 50Ω	10	W
Operating case temperature	T <sub>c</sub> (op)			-30 ~ +110	°C
Storage temperature	T <sub>stg</sub>			-40 ~ +110	°C

## SEMICONDUCTOR DATA

### PLL M54959P(RF UNIT IC2)

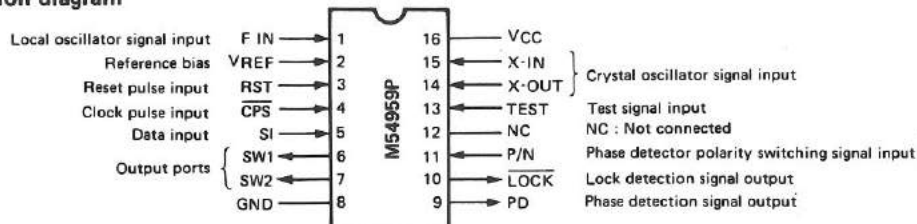
#### ● Block diagram



#### ● Description of terminals

No.	Symbol	Pin name	Description
1	FIN	Local oscillator signal input	Local oscillator frequency (VCO input; fMAX = 500MHz).
2	VREF	Reference bias	Grounded by a 1000pF capacitor.
3	RST	Reset pulse input	Reset pulse input for 21-pulse counter.
4	CPS	Clock pulse input	Clock pulse input for shift register.
5	SI	Data input	Data input for shift register.
6	SW1	Output ports	Output ports whose status is determined by the data sent from the controller.
7	SW2		Open collector.
8	GND	Ground	0V.
9	PD	Phase detection signal output	Tristate.
10	LOCK	Lock detection signal output	"L" when the PLL unit is locked; "H" when it is unlocked. Open collector.
11	P/N	Phase detector polarity switching	When this pin is "H", the PD pin is "H" for phase lead and "L" for phase delay. When this pin is "L", the PD pin is "L" for phase lead and "H" for phase delay.
12	NC	Not connected	Used open or as ground.
13	Test	Test signal input	Usually "L". When this pin is "H", fR (comparison frequency) and fIN/N (programmable divider) are output from SW1 (pin 6) and SW2 (pin 7), respectively.
14	X-OUT	Liquid crystal oscillator signal input	Inputs signals sent from the 12.8MHz basic oscillator to X-IN.
15	X-IN		Oscillation is possible even when an external crystal resonator is used.
16	Vcc	Power supply	4.5~5.5V.

#### ● Terminal connection diagram



## SEMICONDUCTOR DATA

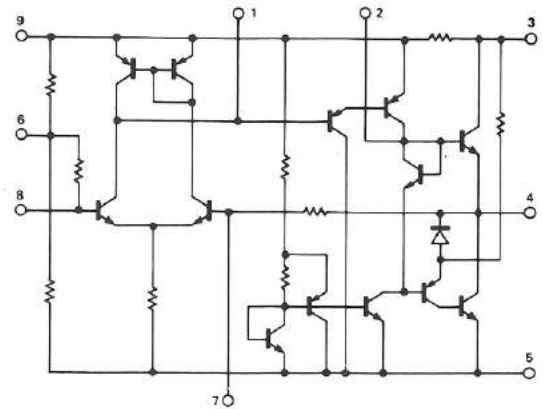
### AF POWER AMP BA526(IF UNIT IC2)

#### ● Electrical characteristic

Item	Symbol	Rating			Unit	Condition
		Min.	Typ.	Max.		
DC current	$I_{CC}$	—	12	24	mA	$V_{IN} = 0V$
Voltage gain	$G_{VC}$	48	52	54	dB	$R_{NF} = 47\Omega, V_{IN} = 2.5mV$
Max. output power	$P_o \text{ MAX}$	600	700	—	mW	$V_{IN} = 25mV$
Spec. output power	$P_o$	350	430	—	mW	T.H.D. = 10%
Noise output voltage	$V_{NO}$	—	0.25	0.7	mV	$R_g = 0\Omega$
Distortion	T.H.D.	—	0.4	2	%	$P_o = 50mW$
Input resistance	$Z_{IN}$	—	22	—	k $\Omega$	1kHz $P_o = 50mW$

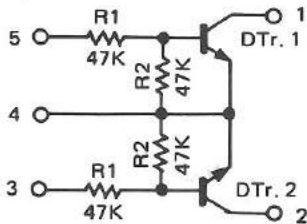
( $T_a = 25^\circ C, V_{CC} = 6V, R_L = 8\Omega, f = 1kHz$ )

#### ● Equivalent circuit



### FMG2 (IF UNIT Q6,10,19)

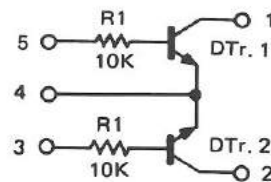
#### ● Equivalent circuit



- 1: Tr1 OUT
- 2: Tr2 OUT
- 3: Tr2 IN
- 4: GND
- 5: Tr1 IN

### FMG4 (RF UNIT Q14)

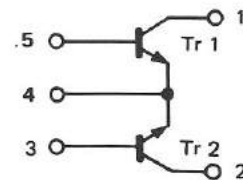
#### ● Equivalent circuit



- 1: Tr1 OUT
- 2: Tr2 OUT
- 3: Tr2 IN
- 4: GND
- 5: Tr1 IN

### FMW1 (IF UNIT Q15, RF UNIT Q5)

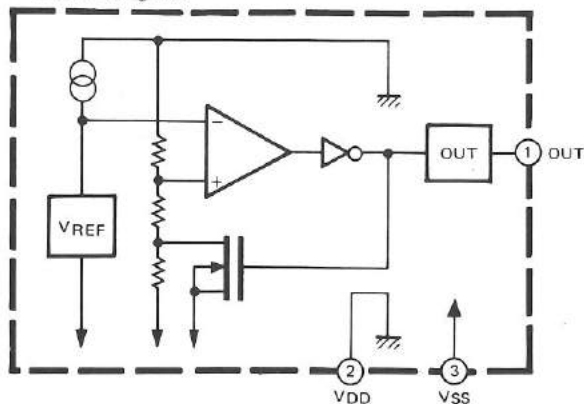
#### ● Equivalent circuit



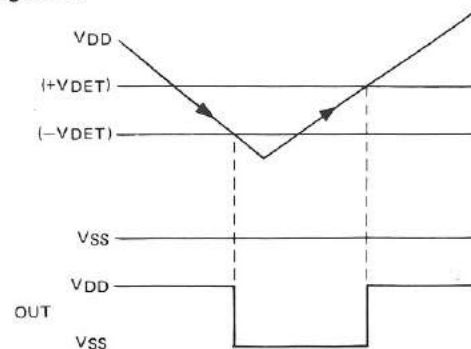
- 1: Tr1 Collector
- 2: Tr2 Collector
- 3: Tr2 Base
- 4: Tr1, 2 Emitter
- 5: Tr1 Base

### BATTERY VOLTAGE DETECTOR S-8054HN (IF UNIT IC3)

#### ● Block diagram



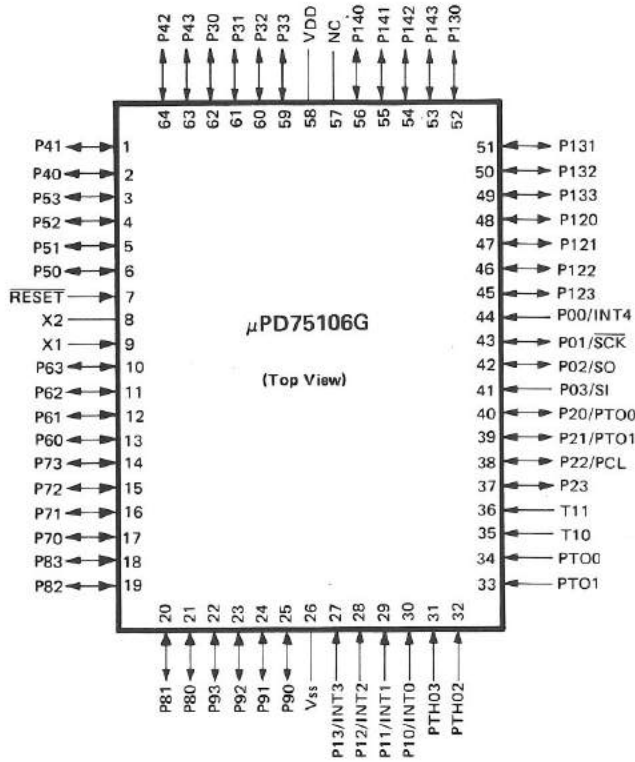
#### ● Timing chart



## SEMICONDUCTOR DATA

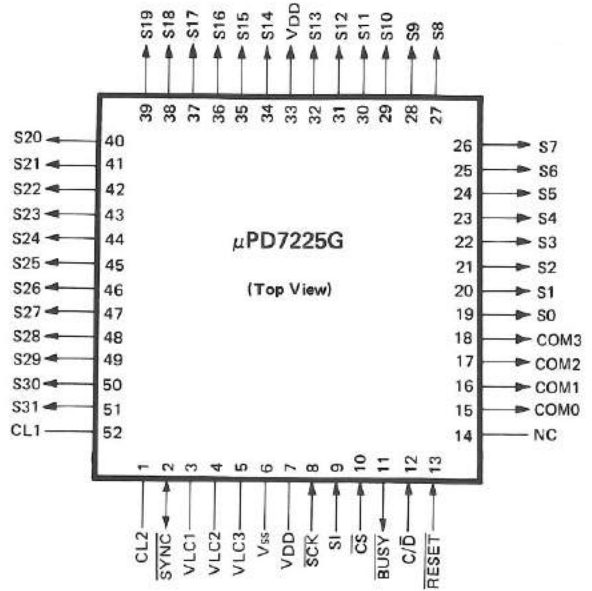
### μPD75106G-524-1B (Case ass'y IC1)

● Terminal connection diagram



### μPD7225G (Case ass'y IC2)

● Terminal connection diagram



### μPD7225G (Case ass'y IC2)

● Terminal functions

Pin No.	Pin name	Function
1	CL2	R connection for CLOCK signal generation.
2	SYNC	Not used.
3	VLC1	LCD driver power supply.
4	VLC2	LCD driver power supply.
5	VLC3	LCD driver power supply.
6	Vss	GND.
7	VDD	Power supply.
8	SCK	Serial clock input.
9	SI	Serial data output.
10	CS	Chip select input.
11	BUSY	BUSY output.
12	C/D	Command/Data select input.
13	RESET	Reset input.
14	NC	Not used.
15	COM0	Common signal output
16	COM1	Common signal output.
17	COM2	Common signal output.
18	COM3	Common signal output.
19~32	S0~S13	Segment signal output.
33	VDD	Not used.
34~51	S14~S31	Segment signal output.
52	CL1	R connection for CLOCK signal generation.



## SEMICONDUCTOR DATA

 $\mu$ PD75106G-524-1B (Case ass'y IC1)

## ● Terminal functions

Pin No.	Port name	I/O	Name	Function
1	P41	O		TONE bit 5.
2	P40	O		TONE bit 4.
3	P53	O		TONE bit 3.
4	P52	O		TONE bit 2.
5	P51	O		TONE bit 1.
6	P50	O		TONE bit 0.
7	RESET	I		Reset.
8	X2	O		X'tal oscillator.
9	X1	I		X'tal oscillator.
10	P63	—		Not used.
11	P62	O	TRS	Power supply for TONE SQL unit, "H" : Power ON, "L" : Power OFF.
12	P61	I		$\mu$ PD7225G RESET.
13	P60	O		$\mu$ PD7225G BUSY.
14	P73	O		$\mu$ PD7225G C/D.
15	P72	O		$\mu$ PD7225G CS.
16	P71	O		$\mu$ PD7225G SI.
17	P70	O		$\mu$ PD7225G SCK.
18	P83	O		DTMF bit 7.
19	P82	O		DTMF bit 6.
20	P81	O		DTMF bit 5.
21	P80	O		DTMF bit 4.
22	P93	O		DTMF bit 3.
23	P92	O		DTMF bit 2.
24	P91	O		DTMF bit 1.
25	P90	O		DTMF bit 0.
26	Vss	—		GND.
27	P13/INT3	I	J4	Customer's pin.
28	P12/INT2	I	J3	Customer's pin.
29	P11/INT1	I	J2	Customer's pin.
30	P10/INT0	I	J1	Customer's pin.
31	PTH03	—		Not used.
32	PTH02	—		Not used.
33	PTH01	I		Battery warning, analog input.
34	PTH00	I	SM	S meter, analog input.
35	T10	I	UL	"H" : PLL Unlocked, "L" : PLL Locked.
36	T11	I	SQ	"H" : SQ Close.
37	P23	O	SAVE	OPEN : Power Save operation, "L" : NORMAL operation.
38	P22/PCL	O	TX	"H" : TX, "L" : RX, OPEN Power Save operation.
39	P21/PT01	O	BEEP	BEEP sound output.
40	P20/PT00	O	AFC	"H" : SP OFF, "L" : SP ON, OPEN Power Save operation.
41	P03/SI	—		Not used.
42	P02/SO	O	TD	DATA for TONE SQL unit.
43	P01/SCK	O	TCK	CLOCK for TONE SQL unit.
44	P00/INT4	I	BU	"H" : Normal operation, "L" : Backup operation switching.
45	P123	—		Not used.
46	P122	I	TS	"H" : TONE OFF, "L" : TONE ON.
47	P121	I	ST	"H" : PTT OFF, "L" : PTT ON.
48	P120	I		Key matrix (DOWN, 0, UP, SCAN).
49	P133	I		Key matrix (7, 8, 9, ENTER).
50	P132	I		Key matrix (4, 5, 6, M).
51	P131	I		Key matrix (1, 2, 3, F).
52	P130	I		Key matrix (OFFSET, REV, SAVE).
53	P143	O		Key matrix (SAVE, M, F, ENTER, SCAN).
54	P142	O		Key matrix (REV, 3, 6, 9, UP).
55	P141	O		Key matrix (OFFSET, 2, 5, 8, 0).
56	P140	O		Key matrix (1, 4, 7, DOWN).
57	NC	—		Not used.
58	VDD	—	VDD	Power supply (+ 5V).
59	P33	—		Not used.
60	P32	O	CPS	CLOCK for PLL IC.
61	P31	O	SI	DATA for PLL IC.
62	P30	O	RST	RESET for PLL IC.
63	P43	O		Tone bit 7.
64	P42	O		Tone bit 6.

## DESCRIPTION OF COMPONENTS

### RF UNIT (W02-0812-08)

Component	Name	Function
IC1	M67723	Transmission power amplification.
IC2	M54959P	PLL.
Q1	2SC2714(O)	VCO output amplifier.
Q2	2SC3838K(N,P)	Transmission amplifier.
Q3	2SC2407	Transmission amplifier.
Q4	2SA1313(Y)	Current control for D3.
Q5	FMW1	APC.
Q6	2SC3356	RF amplifier for reception.
Q7	2SC2714(O)	RF amplifier for reception.
Q8	2SK210(GR)	1st mixer for reception.
Q9	2SC2714(O)	1st IF amplifier for reception.
Q10	2SC3838K(N,P)	HFT (VCO) amplifier.
Q12,Q13	2SC2712(GR)	Active filter.
Q14	FMG4	VCO power supply switching for transmission and reception.
D1	DAN235K	Transmission/reception switching.
D2	DA204K	Q3 bias setting.
D3	1SV172	Control on RF signal input to final module.
D4	DA204K	Q5 bias setting.
D5	MI303	Transmission/reception switching (Transmission : ON).
D6	MI301	Transmission/reception switching (Transmission : ON).
D7	1SS277	Protection of receiving unit against excessive input.
D8,D9	HSM88AS	APC detection.
D14	ERB83-004	Protection against reverse connection.
D15	UZP-22B	Protection against over-voltage.
D16	ERB83-004	Battery protection for the external DC power supply operation.

### IF UNIT (W02-0814-08)

Component	Name	Function
IC1	TA7761P	1st IF amplifier receiver, 2nd OSC, 2nd MIX, 2nd IF amplifier, DISC. ⑦S meter output, ⑨Detection signal output, ⑩AF amplifier output, ⑬Noise amplifier output, ⑭IF signal input.
IC2	BA526	AF power amplifier ④output, ⑧input.
IC3	S-8054HN	Backup reset ① output ("H" → "L" Backup).
IC4	LP2950CZ	Microprocessor power supply ①input, ③output.
IC5	LP2950CZ	KEY, 5V AVR for M5, ① input, ③output.
Q1	2SC2712(GR)	SQL SW, BUSY : OFF.
Q2	2SC2712(GR)	SQL noise amplifier.
Q3	DTC144EK	SQL AUTO/MANUAL SW.
Q4	2SC2712(GR)	AF amplifier.
Q5	2SJ106(GR)	Hysteresis characteristic switching for SQL circuit, BUSY : ON.
Q6	FMG2	SW : ① Turns OFF the MIC input when sound is generated from SP while transmitting (when DTMF, BEEP, etc., output). ② Turns OFF the AF amplifier power supply when AFC is "H"
Q7	2SC2712(GR)	AF amplifier power supply.
Q8	2SA1241(Y)	AF amplifier power supply.
Q9	DTC143XK	BEEP sound amplifier.
Q10	FMG2	SW : ① Turns SPL "L" when using DTMF while transmitting with TONE SQL unit. ② Turns the line for MOD pin "L" to cut the microprocessor noise while receiving.
Q11	DTA143ZK	R5 power supply SW.
Q12	DTA144EK	R5 power supply SW.
Q13	2SA1313(Y)	T5 power supply SW.
Q14	2SA1358(Y)	C5 power supply.
Q15	FMW1	C5 power supply.
Q16	DTC114YK	T5 power supply SW.
Q17	DTC114YK	SW : Turns C5 ON/OFF in SAVE mode.
Q18	DTC114YK	SW : Turns SQ pin "L" in SAVE (C5 OFF) mode.
Q19	FMG2	SW : Forces SQL open when monitoring.
Q20	DTC144EK	SW : Turns MIC input OFF when transmitting DTMF.
D1	HSM88AS	SQL noise rectification.
D3	1SS184	SW : Power supply for AF amplifier, AFC, OR circuit for SPO.
D4	O2CZ7.5Y	AVR
D5	O2CZ8.2	AVR
D6	1SS184	SW : Switching for microprocessor power supply.
D7	1SS226	AVR voltage shift (approx. 0.6V).

## PARTS LIST

### CAPACITORS

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

CC45



#### Capacitor value

1 0 3 = 0.01μF

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

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

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

#### Temperature Coefficient

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

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

Example CC45TH = -470±60 ppm/°C

#### Tolerance

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

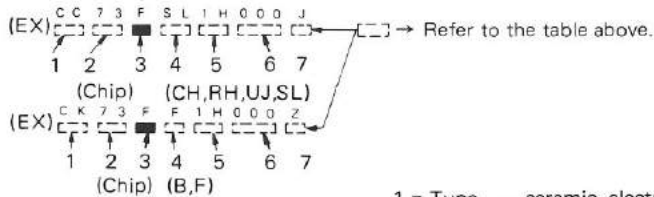
Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

#### Rating voltage

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

#### Chip capacitors



#### Dimension

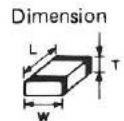
Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

#### Dimension

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

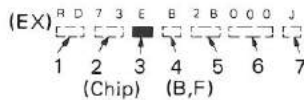
#### Rating wattage

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



### RESISTORS

#### Chip resistor (Carbon)



#### Carbon resistor (Normal type)



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

## PARTS LIST

### SEMICONDUCTOR

N : New parts

Item	Re- marks	Part No.
Diode		1SS277
		ERB83-004
		MI301 MI303
Vari-cap diode		1SV153
Chip diode		1SS184 1SS226 1SV172
		DA204K DAN235K
		HSM88AS
Zener diode		UZP-22B
Chip zener diode		02CZ7.5Y 02CZ8.2
Thermister		112-101-2 112-202-2
Posistor		PTH59T103M
LCD		FTD8391
FET	N	2SK210(GR)
TR		2SA1241(Y) 2SA1358(Y) 2SB1182F5 2SC2407

Item	Re- marks	Part No.	
Chip TR		2SA1313(Y)	
		2SC2412K 2SC2712(GR) 2SC2714(O) 2SC3356 2SC3838K(N,P)	
		2SJ106(GR)	
	Digital TR		DTA114YK DTA143ZK DTA144EK DTC114YK DTC143XK DTC144EK
			FMG2 FMG4 FMW1
Power module		N	M67723
			BA526
IC			LP2950CZ
		M54959P	
		NJM4560M	
		S-8054HN	
		TA7761P	
		$\mu$ PD7225G $\mu$ PD75106G-514-1B	

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<b>TH-315A</b>						
1	3B		A01-1018-15	METALLIC CABINET		
5	1A		A02-0842-05	PLASTIC CABINET		
7	3A	*	A20-2612-14	PANEL ASSY		
10	3B		A40-0620-23	BOTTOM PLATE		
14	3C		B09-0307-14	CAP		
17	3A	*	B40-3794-04	MODEL NAME PLATE		
18	1D	*	B50-8217-00	INSTRUCTION MANUAL		
19	1D		B46-0410-20	WARRANTY CARD		
20	1D		B58-0686-04	CAUTION CARD		
-			B42-2437-04	SERIAL PLATE		
-			B42-2454-04	SERIAL PLATE		
21	3B		D10-0602-04	LEVER (RELEASE)		
22	2B		E23-0474-14	TERMINAL (BATT)		
23	3B		E23-0432-04	TERMINAL		
29	2A		E31-3209-05	CONNECTING LEAD WIRE(2P)		
40	2A		E40-5089-05	PIN CONNECTOR (24P)		
-			E30-2078-25	DC CORD		
-			E31-3207-08	FLAT CABLE (15P)		
-			E31-3211-08	FLAT CABLE (10P)		
32	2B		F19-0646-04	BLIND PLATE		
34	1A		F20-0521-04	INSULATING SHEET(BATT,-)		
35	3A		F20-0574-04	INSULATING BOARD		
36	1A		F20-0520-04	INSULATING SHEET(BATT,+)		
-			F05-3022-05	FUSE (3A)		
40	3B		G01-0833-04	COIL SPRING (LEVER)		
41	3A		G01-0834-04	COIL SPRING (PANEL)		
43	2A		G10-0644-04	NON-WOVEN FABRIC		
44	2B		G11-0617-04	CUSHION		
46	3A		G13-0846-04	CUSHION		
47	2A		G13-0814-04	CUSHION		
-			G01-0837-05	COIL SPRING (MONI)		
48	2C	*	H01-8163-02	ITEM CARTON BOX		
49	1D		H21-0713-04	AIR PACKING		
50	1D		H11-0808-14	PACKING (BOARD)		
51	3D		H11-0809-04	PACKING (10X20X68)		
52	1C,3C		H13-0801-04	BUFFER		
53	2D		H25-0103-04	PROTECTION BAG		
54	3D		H10-2618-12	POLYSTYRENE FOAMED FIXTURE		
55	2D		H25-0116-04	PROTECTION BAG		
56	1C,2C		H25-0120-04	PROTECTION BAG		
57	3C		H25-0076-03	PROTECTION BAG		
58	2D		J29-0417-04	BELT HOOK		
59			J39-0428-04	SPACER		
63	2A		K23-0787-04	KNOB (VOL,SQL)		
64	3A		K27-0494-04	KNOB (LOW, TONE)		
-			K29-3054-15	KNOB (PTT)		
-			K29-3055-15	KNOB (MONI)		
76	3D		N16-0030-41	SPRING WASHER (FOR BELT HOOK)		
77	2D		N35-3005-41	BINDING HEAD MACHINE SCREW		
78	3A		N19-0638-04	FLAT WASHER		

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A	3A, 3B		N09-2002-05	SCREW (2X20)		
B	2A		N09-2008-05	SCREW (2.6X8)		
C	3A, 3B		N09-2009-15	SCREW (2X4.5)		
D	2B		N09-2010-15	SCREW (2X6)		
G	2B		N35-2005-41	BINDING HEAD MACHINE SCREW		
H	1A, 1B		N35-2608-41	BINDING HEAD MACHINE SCREW		
K	2A		N87-2605-46	BRAZIER HEAD TAPTITE SCREW		
92	3D	*	T90-0363-08	ANTENNA		
95	2C		W09-0315-25	BATTERY CHARGER		
103	2D		W09-0361-05	BATTERY PACK		
106	2B	*	W02-0812-08	RF UNIT		
107	2A	*	W02-0814-08	IF UNIT		
<b>CASE ASS'Y (A02-0842-05)</b>						
200	2B		A02-0843-08	CASE (FRONT)		
201	1B		A33-0407-08	REFLECTOR		
202	1B		B10-0693-08	FRONT GLASS		
-			B03-0542-08	DRESSING PLATE		
-			B30-0849-05	LAMP (3V, 60MA)		
203	1B		E29-0476-08	LCD CONNECTOR (15P)		
204	2B		G01-0837-05	COMPRESSION SPRING		
205	2B		J31-0526-04	MIC SPACER		
206	2B		K29-3054-05	KNOB (PTT)		
207	2B		K29-3055-05	KNOB (MONI)		
R10			KRR-C001	H. IC		
R18			KRR-C001	H. IC		
209	1B		T07-0244-08	SPEAKER (12 OHM)		
210	1B		T91-0312-15	MICROPHONE		
211			FTD8391	LCD		
D1			02CZ8.2	DIODE		
D2			DA204K	DIODE		
IC1			75106G-524-1B	IC (MICROPROCESSOR)		
IC2			UPD7225G	IC		
Q1			2SC2412K	TRANSISTOR		
Q2			2SB1182	TRANSISTOR		
<b>MIC AMP (X59-3090-10)</b>						
C1			CK73FB1E223K	CHIP C 0.022UF K		
C2			CK73FB1H471K	CHIP C 470PF K		
C3			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C4			CK73FB1H182K	CHIP C 1800PF K		
C5			CC73FCH1H151J	CHIP C 150PF J		
C6			CK73FB1H103K	CHIP C 0.010UF K		
C7			CK73FB1H471K	CHIP C 470PF K		
R1			RK73FB2A104J	CHIP R 100K J 1/10W		
R2			RK73FB2A103J	CHIP R 10K J 1/10W		
R3	,4		RK73FB2A472J	CHIP R 4.7K J 1/10W		
R5			RK73FB2A391J	CHIP R 390 J 1/10W		
R6			RK73FB2A823J	CHIP R 82K J 1/10W		

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R7 ,8 R9			RK73FB2A104J RK73FB2A472J	CHIP R 100K J 1/10W CHIP R 4.7K J 1/10W		
IC1			NJM4560M	IC(OP AMP X2)		
<b>RF UNIT (W02-0812-08)</b>						
108	2C		A22-0749-13	SUB PANEL		
C1 ,2 C3 ,4 C5 -7 C8 C9			CK73FB1H103K CK73FB1H102K CK73FB1H103K CC73FCH1H030C CC73FCH1H060C	CHIP C 0.010UF K CHIP C 1000PF K CHIP C 0.010UF K CHIP C 3.0PF C CHIP C 6.0PF C		
C10 -12 C13 C15 -19 C20 C21			CK73FB1H103K CC73FCH1H060C CK73FB1H103K C90-2039-05 C90-2048-05	CHIP C 0.010UF K CHIP C 6.0PF C CHIP C 0.010UF K ELECTR0 15UF 16WV ELECTR0 6.8UF 6.3WV		
C22 C23 C24 C25 C26 -29			C90-2039-05 CK73EB1E104K C90-2053-05 C90-0478-05 CK73FB1H103K	ELECTR0 15UF 16WV CHIP C 0.10UF K ELECTR0 47UF 6.3WV ELECTR0 10UF 16WV CHIP C 0.010UF K		
C30 C31 ,32 C33 C34 ,35 C36			C90-0484-05 CK73FB1H103K CC73FCH1H220J CC73FCH1H010C CK73FB1H102K	ELECTR0 0.47UF 50WV CHIP C 0.010UF K CHIP C 22PF J CHIP C 1.0PF C CHIP C 1000PF K		
C37 ,38 C39 C40 ,41 C42 C43			CC73FCH1H010C CC73FCH1H220J CK73FB1H103K CC45CH1H120J CC73FCH1H060C	CHIP C 1.0PF C CHIP C 22PF J CHIP C 0.010UF K CERAMIC 12PF J CHIP C 6.0PF C		
C44 C45 C48 C49 ,50 C52			CC73FCH1H150J CC73FCH1H030C CC73FCH1H101J CK73FB1H102K CC73FCH1H050C	CHIP C 15PF J CHIP C 3.0PF C CHIP C 100PF J CHIP C 1000PF K CHIP C 5.0PF C		
C53 C54 C56 C57 C58			CK73FB1H103K CC73FCH1H0R5C CC73FCH1H060C CK73FB1H103K CC73FCH1H0R5C	CHIP C 0.010UF K CHIP C 0.5PF C CHIP C 6.0PF C CHIP C 0.010UF K CHIP C 0.5PF C		
C59 C61 C62 C63 -65 C66			CC73FCH1H030C CK73FB1H103K CC73FCH1H150J CK73FB1H103K CC73FCH1H070D	CHIP C 3.0PF C CHIP C 0.010UF K CHIP C 15PF J CHIP C 0.010UF K CHIP C 7.0PF D		
C67 C68 ,69 C70 C71 C72			CC73FCH1H330J CK73FB1H103K CC73FCH1H020C CC73FCH1H090D C90-2053-05	CHIP C 33PF J CHIP C 0.010UF K CHIP C 2.0PF C CHIP C 9.0PF D ELECTR0 47UF 6.3WV		
C73 C74 C75			CK73FB1H103K CC73FCH1H560J CC73FCH1H150J	CHIP C 0.010UF K CHIP C 56PF J CHIP C 15PF J		

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C77			C90-0478-05	ELECTRO 10UF 16WV		
C78			CK73FB1H102K	CHIP C 1000PF K		
C79			CK73FB1E103K	CHIP C 0.010UF K		
C80			CK73FB1H182K	CHIP C 1800PF K		
C81			CC73FCH1H101J	CHIP C 100PF J		
C82			CC73FSL1H471J	CHIP C 470PF J		
C83			CK73FB1H103K	CHIP C 0.010UF K		
C84			CS15E1C010M	TANTAL 1.0UF 16WV		
C85			CS15E1VR47M	TANTAL 0.47UF 35WV		
C86 ,87			CK73FB1H103K	CHIP C 0.010UF K		
C88			CK73FB1H102K	CHIP C 1000PF K		
C89			CK73EB1E104K	CHIP C 0.10UF K		
C90			C90-1408-05	ELECTRO 220UF 6.3WV		
C101			CK73FB1H102K	CHIP C 1000PF K		
C102			CC73FCH1H090D	CHIP C 9.0PF D		
C104			CK45CH1H330J	CERAMIC 33PF J		
C106,111,112			CK45B1H102K	CERAMIC 1000PF K		
C114-116			CK45B1H102K	CERAMIC 1000PF K		
TC1			C05-0326-05	TRIMMER (10PF)		
-			E29-0472-04	TERMINAL		
CN1			E40-5090-05	PIN CONNECTOR		
CN2			E40-3237-05	PIN CONNECTOR		
J1	2A		E11-0420-15	PHONE JACK (MIC)		
J2	2A		E11-0421-15	PHONE JACK (SP)		
J3	2A		E03-0165-05	DC IN JACK		
J4	2A		E04-0160-05	RF COAXIAL CABLE RECEPTACLE		
TP1 ,2			E23-0443-05	TERMINAL		
-			F02-0427-14	HEAT SINK		
-			F11-1038-24	SHIELDING COVER(PLL)		
-			J21-4217-04	MOUNTING HARDWARE		
-			J30-0545-05	SPACER		
-			J31-0503-05	COLLAR		
-			J39-0425-14	SPACER		
110	2A	*	L78-0042-08	VCO UNIT		
L1			L40-1581-80	SMALL FIXED INDUCTOR		
L2			L40-3372-80	SMALL FIXED INDUCTOR		
L3			L40-8272-80	SMALL FIXED INDUCTOR		
L4			L40-5672-80	SMALL FIXED INDUCTOR		
L5 -7			L33-0680-05	CHOKO COIL		
L9			L40-1092-14	SMALL FIXED INDUCTOR		
L10 ,11		*	L34-1219-08	COIL		
L12 ,13		*	L34-1220-08	COIL		
L14		*	L34-4082-08	COIL		
L15		*	L34-4081-08	COIL		
L16 ,17		*	L34-4082-08	COIL		
L18			L40-1001-14	SMALL FIXED INDUCTOR		
L19		*	L34-4083-08	COIL		
L20 ,21			L40-1581-80	SMALL FIXED INDUCTOR		
L22			L33-0680-05	CHOKO COIL		
L23			L92-0110-05			
L24 ,25			L40-1021-14	SMALL FIXED INDUCTOR		
L26			L40-1092-14	SMALL FIXED INDUCTOR		
L101		*	L34-1225-08	COIL		
L102		*	L34-1221-08	COIL		

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L103, 104 X1 XF1 ,2			L92-0110-05 L77-1325-05 L71-0276-05	FERRITE BEAD CRYSTAL RESONATOR(12.8MHZ) CRYSTAL FILTER		
- F	2A		N19-0638-04 N09-2016-05	FLAT WASHER SCREW		
JP1			R92-0150-05	JUMPER REST 0.0HM		
R1			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R2			RK73FB2A153J	CHIP R 15K J 1/10W		
R3			RK73FB2A471J	CHIP R 470 J 1/10W		
R4			RK73FB2A821J	CHIP R 820 J 1/10W		
R5			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R6			RK73FB2A103J	CHIP R 10K J 1/10W		
R7			RK73FB2A101J	CHIP R 100 J 1/10W		
R9			RK73FB2A560J	CHIP R 56 J 1/10W		
R10			RK73FB2A470J	CHIP R 47 J 1/10W		
R11			RK73FB2A220J	CHIP R 22 J 1/10W		
R12			RK73FB2A103J	CHIP R 10K J 1/10W		
R13			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R15			RK73FB2A120J	CHIP R 12 J 1/10W		
R16 ,17			RK73FB2A331J	CHIP R 330 J 1/10W		
R18			RK73FB2A221J	CHIP R 220 J 1/10W		
R19			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R20			RK73FB2A333J	CHIP R 33K J 1/10W		
R21			RK73FB2A103J	CHIP R 10K J 1/10W		
R22			RK73FB2A221J	CHIP R 220 J 1/10W		
R23 ,24			RK73FB2A820J	CHIP R 82 J 1/10W		
R25			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R30			RD14BB2C103J	RD 10K J 1/6W		
R31			RK73FB2A271J	CHIP R 270 J 1/10W		
R32			RD14BB2C103J	RD 10K J 1/6W		
R33			RK73FB2A103J	CHIP R 10K J 1/10W		
R36			RD14BB2C470J	RD 47 J 1/6W		
R40			RK73FB2A470J	CHIP R 47 J 1/10W		
R41			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R42			RK73FB2A470J	CHIP R 47 J 1/10W		
R44			RK73FB2A103J	CHIP R 10K J 1/10W		
R45			RD14BB2C471J	RD 470 J 1/6W		
R46			RD14BB2C470J	RD 47 J 1/6W		
R46			RD14BB2C823J	RD 82K J 1/6W		
R47			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R48			RD14BB2C101J	RD 100 J 1/6W		
R49			RK73FB2A334J	CHIP R 330K J 1/10W		
R50			RK73FB2A470J	CHIP R 47 J 1/10W		
R51			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R52			RK73FB2A223J	CHIP R 22K J 1/10W		
R53			RK73FB2A104J	CHIP R 100K J 1/10W		
R54			RK73FB2A223J	CHIP R 22K J 1/10W		
R58			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R59			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R60			RK73FB2A823J	CHIP R 82K J 1/10W		
R61			RK73FB2A103J	CHIP R 10K J 1/10W		
R62			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R63			RK73FB2A394J	CHIP R 390K J 1/10W		
R64			RK73FB2A104J	CHIP R 100K J 1/10W		

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R65			RK73FB2A473J	CHIP R 47K J 1/10W		
R101			RK73FB2A101J	CHIP R 100 J 1/10W		
R102			RK73FB2A394J	CHIP R 390K J 1/10W		
R103			RK73FB2A101J	CHIP R 100 J 1/10W		
R104			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R105-107			RK73FB2A472J	CHIP R 4.7K J 1/10W		
D1		*	DAN235K	DIODE		
D2			DA204K	DIODE		
D3			1SV172	DIODE		
D4			DA204K	DIODE		
D5			MI303	DIODE		
D6			MI301	DIODE		
D7			1SS277	DIODE		
D8 ,9			HSM88AS	DIODE		
D14			ERB83-004	DIODE		
D15			UZP-22B	DIODE		
D16			ERB83-004	DIODE		
IC1		*	M67723	IC(POWER MODULE)		
IC2			M54959P	IC(FREQ SYNTHESIZER PLL)		
Q1			2SC2714(N)	TRANSISTOR		
Q2			2SC3838K(N,P)	TRANSISTOR		
Q3			2SC2407	TRANSISTOR		
Q4			2SA1313(Y)	TRANSISTOR		
Q5			FMW1	TRANSISTOR		
Q6			2SC3356	TRANSISTOR		
Q7			2SC2714(N)	TRANSISTOR		
Q8			2SK210(GR)	FET		
Q9			2SC2714(N)	TRANSISTOR		
Q10			2SC3838K(N,P)	TRANSISTOR		
Q12 ,13			2SC2712(GR)	TRANSISTOR		
Q14			FMG4	TRANSISTOR		
<b>IF UNIT (W02-0814-08)</b>						
C1			C90-1248-05	ELECTRO 1UF 50WV		
C2			CK73FB1H471K	CHIP C 470PF K		
C3 ,4			CK73FB1H102K	CHIP C 1000PF K		
C5 ,6			C90-0890-05	TANTAL 1UF 16WV		
C7			C91-0769-05	CERAMIC 0.01UF M		
C8			CK73FB1H103K	CHIP C 0.010UF K		
C9			C90-0888-05	TANTAL 0.1UF 16WV		
C10			CK73FB1H102K	CHIP C 1000PF K		
C11			CC73FCH1H390J	CHIP C 39PF J		
C12			CK73FB1H102K	CHIP C 1000PF K		
C13			CK73FB1H123K	CHIP C 0.012UF K		
C14			CK73FB1H122K	CHIP C 1200PF K		
C15			CK73FB1H102K	CHIP C 1000PF K		
C16			CK73FB1H123K	CHIP C 0.012UF K		
C17			CK73FB1H103K	CHIP C 0.010UF K		
C19			CK73FB1H223K	CHIP C 0.022UF K		
C20			CK73FB1H102K	CHIP C 1000PF K		
C23			CC73FCH1H820J	CHIP C 82PF J		
C24			CC73FCH1H330J	CHIP C 33PF J		
C25 -27			CK73EB1E104K	CHIP C 0.10UF K		
C28			C90-2050-05	ELECTRO 33UF 6.3WV		
C29			CK73EB1E104K	CHIP C 0.10UF K		

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C30			C90-1248-05	ELECTR0 1UF 50WV		
C31			C90-0890-05	TANTAL 1UF 16WV		
C32			CK73FB1H102K	CHIP C 1000PF K		
C33			CK73FB1H222K	CHIP C 2200PF K		
C34 ,35			CK73FB1H102K	CHIP C 1000PF K		
C35			CK73FB1H681K	CHIP C 680PF K		
C36			CE04CW1A470M	ELECTR0 47UF 10WV		
C37 ,38			C90-2012-05	ELECTR0 100UF 10WV		
C39			C91-1015-05	FILM 0.18UF 63WV		
C40 ,41			C90-0885-05	TANTAL 10UF 6.3WV		
C42			CK73FB1H103K	CHIP C 0.010UF K		
C43			CE04CW1A330M	ELECTR0 33UF 10WV		
C44			C90-1248-05	ELECTR0 1UF 50WV		
C45			CK73FB1H102K	CHIP C 1000PF K		
C46			C90-1248-05	ELECTR0 1UF 50WV		
C47			CE04CW1C220M	ELECTR0 22UF 16WV		
C48			CE04CW1C470M	ELECTR0 47UF 16WV		
C49			CK73FF1E104Z	CHIP C 0.10UF Z		
C50			CK73FB1H471K	CHIP C 470PF K		
C51			CE04CW1C4R7M	ELECTR0 4.7UF 16WV		
C52			CK73FB1H152K	CHIP C 1500PF K		
C53			CK73FB1H103K	CHIP C 0.010UF K		
C54			C90-0891-05	TANTAL 4.7UF 16WV		
C56 ,57			CK73FB1H103K	CHIP C 0.010UF K		
C58			CE04CW1HR22M	ELECTR0 0.22UF 50WV		
C59			CK73FB1H102K	CHIP C 1000PF K		
C60			C90-0868-05	ELECTR0 10UF 16WV		
C61 ,62			CK73FB1H471K	CHIP C 470PF K		
C63			C90-0868-05	ELECTR0 10UF 16WV		
C64			CK73FB1H102K	CHIP C 1000PF K		
C68			C90-2011-05	ELECTR0 4.7UF 25WV		
C69			C90-1248-05	ELECTR0 1UF 50WV		
C70			CK73FB1H471K	CHIP C 470PF K		
C71			CE04CW0J220M	ELECTR0 22UF 6.3WV		
C72 -74			CK73FB1H471K	CHIP C 470PF K		
C75			C90-1248-05	ELECTR0 1UF 50WV		
C76			C90-2048-05	ELECTR0 6.8UF 6.3WV		
C77 -79			CK73FB1H102K	CHIP C 1000PF K		
C83			CE04CW1C470M	ELECTR0 47UF 16WV		
C84			CK73FB1H471K	CHIP C 470PF K		
C85			C90-2049-05	ELECTR0 15UF 6.3WV		
C86			CK73FB1H471K	CHIP C 470PF K		
C87			C90-2048-05	ELECTR0 6.8UF 6.3WV		
C88			CK73FB1H102K	CHIP C 1000PF K		
C89			CK73FB1H471K	CHIP C 470PF K		
C90			CK73FB1H102K	CHIP C 1000PF K		
C91			CK73FB1H471K	CHIP C 470PF K		
C92			C90-2073-05	ELECTR0 6.8UF 16WV		
C93 -96			CK73FB1H102K	CHIP C 1000PF K		
C97			CK73FB1H471K	CHIP C 470PF K		
C98			C90-2049-05	ELECTR0 15UF 6.3WV		
C100			CK73FB1H471K	CHIP C 470PF K		
C102			CE04CW1C220M	ELECTR0 22UF 16WV		
C103			CK73FB1H471K	CHIP C 470PF K		
C105			CK73FB1H471K	CHIP C 470PF K		

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C107			C91-0753-05	CHIP C 470PF K		
C108			CK73FB1H471K	CHIP C 470PF K		
C109			C91-0757-05	CERAMIC 0.001UF K		
C111			C90-1248-05	ELECTRØ 1UF 50WV		
C112			CE04CWOJ220M	ELECTRØ 22UF 6.3WV		
CN1			E40-5089-05	PIN CONNECTØR (24P)		
CN2			E40-5039-05	PIN CONNECTØR (5P)		
CN3			E40-5021-05	PIN CONNECTØR (7P)		
CN4			E23-0443-05	TERMINAL (10P)		
112	1A		K01-0414-04	HANDLE		
CF1			L72-0335-05	MCF (CFU455E2)		
L2 ,3			L30-0538-05	IFT		
L4			L40-4791-14	SMALL FIXED INDUCTØR		
L5 -8			L92-0122-05	BEAD CORE		
X1		*	L77-1372-08	CRYSTAL RESONATOR(16.445MHZ)		
CJ1 -3			R92-0670-05	CHIP R 0 ØHM		
JP1 ,2			R92-1061-05	JUMPER REST 0 ØHM		
R1			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R2			RK73FB2A271J	CHIP R 270 J 1/10W		
R3			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R4			RK73FB2A271J	CHIP R 270 J 1/10W		
R5			RK73FB2A474J	CHIP R 470K J 1/10W		
R6			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R7			RK73FB2A564J	CHIP R 560K J 1/10W		
R8			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R9			RK73FB2A153J	CHIP R 15K J 1/10W		
R10			RK73FB2A473J	CHIP R 47K J 1/10W		
R11			RK73FB2A223J	CHIP R 22K J 1/10W		
R12			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R13			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R14			RK73FB2A103J	CHIP R 10K J 1/10W		
R15 ,16			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R17			RK73FB2A823J	CHIP R 82K J 1/10W		
R18			RK73FB2A333J	CHIP R 33K J 1/10W		
R19			RK73FB2A223J	CHIP R 22K J 1/10W		
R20			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R20			RK73FB2A103J	CHIP R 10K J 1/10W		
R21			RK73FB2A473J	CHIP R 47K J 1/10W		
R23			RK73FB2A103J	CHIP R 10K J 1/10W		
R24			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R25			RK73FB2A473J	CHIP R 47K J 1/10W		
R26			RD14BB2C123J	RD 12K J 1/6W		
R27			RD14BB2C394J	RD 390K J 1/6W		
R28			RK73FB2A471J	CHIP R 470 J 1/10W		
R29 ,30			RK73FB2A103J	CHIP R 10K J 1/10W		
R31			RK73FB2A333J	CHIP R 33K J 1/10W		
R32			RD14CB2C822J	RD 8.2K J 1/6W		
R33			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R34			RK73FB2A333J	CHIP R 33K J 1/10W		
R35			RK73FB2A103J	CHIP R 10K J 1/10W		
R36			RK73FB2A473J	CHIP R 47K J 1/10W		
R37			RK73FB2A100J	CHIP R 10 J 1/10W		
R38			RD14CB2C222J	RD 2.2K J 1/6W		
R39			RK73FB2A273J	CHIP R 27K J 1/10W		

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R40			RK73FB2A223J	CHIP R 22K J 1/10W		
R41			RK73FB2A103J	CHIP R 10K J 1/10W		
R42			RK73FB2A151J	CHIP R 150 J 1/10W		
R43			RK73FB2A224J	CHIP R 220K J 1/10W		
R44			RK73FB2A474J	CHIP R 470K J 1/10W		
R45			RD14BB2C472J	RD 4.7K J 1/6W		
R46			RK73FB2A473J	CHIP R 47K J 1/10W		
R47			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R48			RD14CB2C222J	RD 2.2K J 1/6W		
R49			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R50			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R51			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R52			RK73FB2A124J	CHIP R 120K J 1/10W		
R53			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R54			RK73FB2A473J	CHIP R 47K J 1/10W		
R55			RK73FB2A223J	CHIP R 22K J 1/10W		
R56			RK73FB2A473J	CHIP R 47K J 1/10W		
R57			RK73FB2A223J	CHIP R 22K J 1/10W		
R58			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R59			RK73FB2A221J	CHIP R 220 J 1/10W		
VR1			R12-3447-05	TRIMMING POT(10K)		
VR2			R12-1431-05	TRIMMING POT(1K)		
VR3	1A		R05-4419-05	POTENTIOMETER(50K)SQ		
VR4	1A		R05-3440-05	POTENTIOMETER(10K)AF		
VR5			R12-6406-05	TRIMMING POT(470K)		
VR6			R12-1437-05	TRIMMING POT(3.3K)		
VR7			R12-1436-05	TRIMMING POT(1K)		
VR8			R12-5422-05	TRIMMING POT(100K)		
S1 ,2	2B		S40-1412-05	TACT SWITCH (PTT,MONI)		
S3 ,4	1A		S40-1401-05	PUSH SWITCH (TONE,HI/LOW)		
D1			HSM88AS	DIODE		
D3			1SS184	DIODE		
D4			02CZ7.5Y	DIODE		
D5			02CZ8.2	DIODE		
D6			1SS184	DIODE		
D7			1SS226	DIODE		
IC1			TA7761P	IC(FM IF)		
IC2			BA526	IC(AF POWER AMP/ 700MW)		
IC3			S-8054HN	IC(VOLTAGE DETECTOR)		
IC4 ,5			LP2950CZ	IC(VOLTAGE REGULATOR/ +5V)		
Q1 ,2			2SC2712(GR)	TRANSISTOR		
Q3			DTC144EK	DIGITAL TRANSISTOR		
Q4			2SC2712(GR)	TRANSISTOR		
Q5			2SJ106(GR)	FET		
Q6			FMG2	TRANSISTOR		
Q7			2SC2712(GR)	TRANSISTOR		
Q8			2SA1241(Y)	TRANSISTOR		
Q9			DTC143XK	DIGITAL TRANSISTOR		
Q10			FMG2	TRANSISTOR		
Q11			DTA143ZK	DIGITAL TRANSISTOR		
Q12			DTA144EK	DIGITAL TRANSISTOR		
Q13			2SA1313(Y)	TRANSISTOR		
Q14			2SA1358(Y)	TRANSISTOR		
Q15			FMW1	TRANSISTOR		

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Q16 -18 Q19 Q20 TH1 TH2  TH3			DTC114YK FMG2 DTC144EK PTH59T103M 112-202-2  112-101-2	DIGITAL TRANSISTOR TRANSISTOR DIGITAL TRANSISTOR RESISTOR THERMISTOR  THERMISTOR		
B1	1B		W09-0371-05	LITHIUM BATTERY(CR2032-T12)		
<b>VCO (L78-0042-08)</b>						
C1 C2 C3 C4 C5			CC73FCH1H030C CC73FUJ1H330J CC73FCH1H030C CC73FCH1H080D CC73FUJ1H330J	CHIP C 3.0PF C CHIP C 33PF J CHIP C 3.0PF C CHIP C 8.0PF D CHIP C 33PF J		
C6 C7 C8 C9 C10			CK73FB1H103K CK73EB1E104K CS15E1C100M CC73FCH1H020C CK73FB1H102K	CHIP C 0.010UF K CHIP C 0.10UF K TANTAL 10UF 16WV CHIP C 2.0PF C CHIP C 1000PF K		
C11 C12 C13 C14 C15			CC73FUJ1H330J CC73FCH1H030C CC73FCH1H080D CC73FUJ1H330J CC73FCH1H020C	CHIP C 33PF J CHIP C 3.0PF C CHIP C 8.0PF D CHIP C 33PF J CHIP C 2.0PF C		
C16 TC1 ,2			CK73FB1H102K C05-0326-05	CHIP C 1000PF K TRIMMER (10PF)		
-			E23-0465-05	TERMINAL		
116 -	2B		F20-0575-04 F11-1039-04	INSULATING BOARD SHIELDING COVER		
L1 L2 L3 L4		*	L34-1223-08 L40-1892-81 L34-1222-08 L40-1892-81	COIL SMALL FIXED INDUCTOR COIL SMALL FIXED INDUCTOR		
R1 R2 R3 R4 R5 ,6			RK73FB2A104K RK73FB2A564K RK73FB2A104K RK73FB2A150K RK73FB2A333K	CHIP R 100K K 1/10W CHIP R 560K K 1/10W CHIP R 100K K 1/10W CHIP R 15 K 1/10W CHIP R 33K K 1/10W		
R7 R8 R9			RK73FB2A564K RK73FB2A104K RK73FB2A150K	CHIP R 560K K 1/10W CHIP R 100K K 1/10W CHIP R 15 K 1/10W		
D1 -3 Q1 ,2			1SV153 2SK210(GR)	DIODE FET		

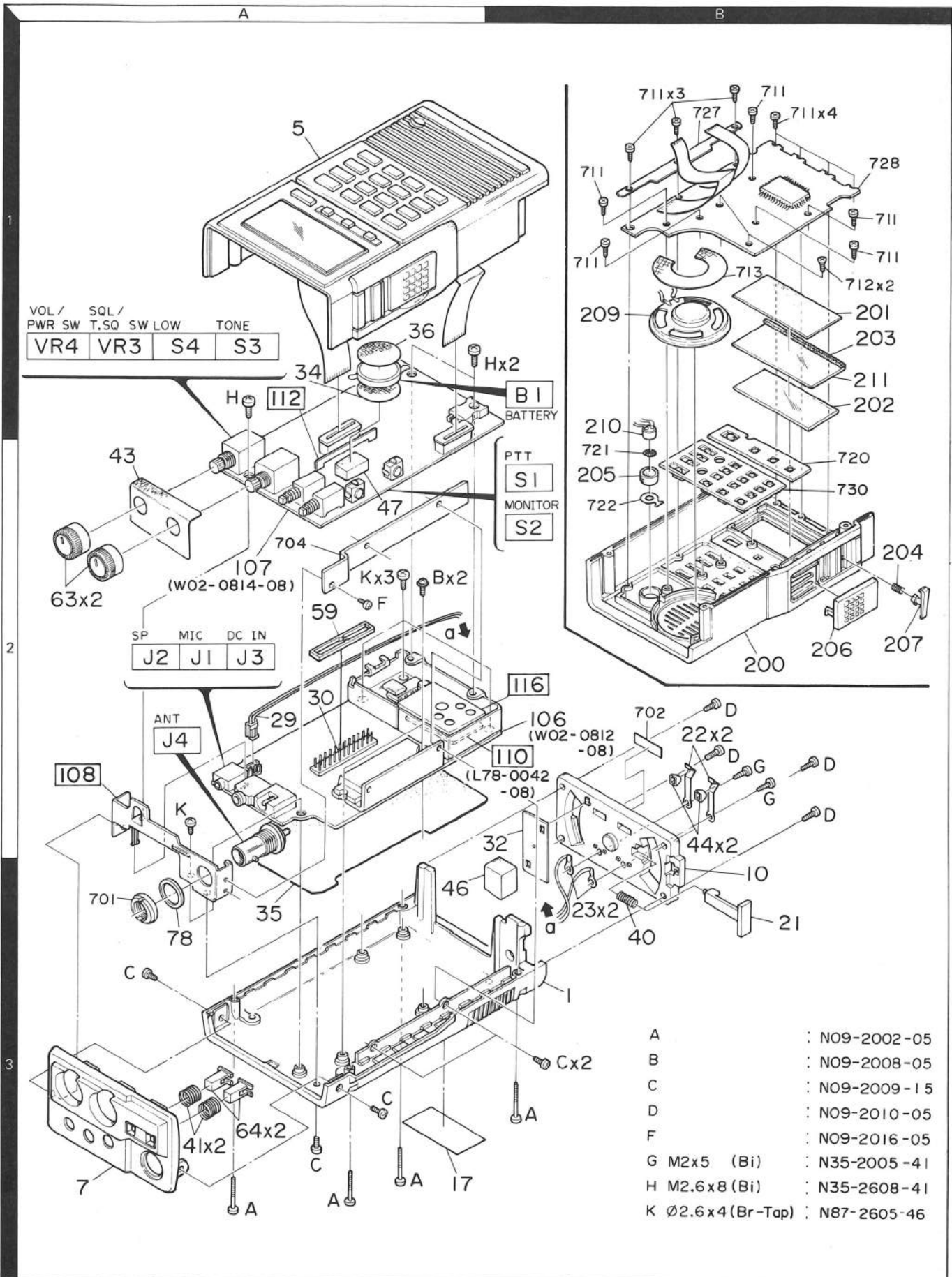
E: Scandinavia & Europe K: USA P: Canada

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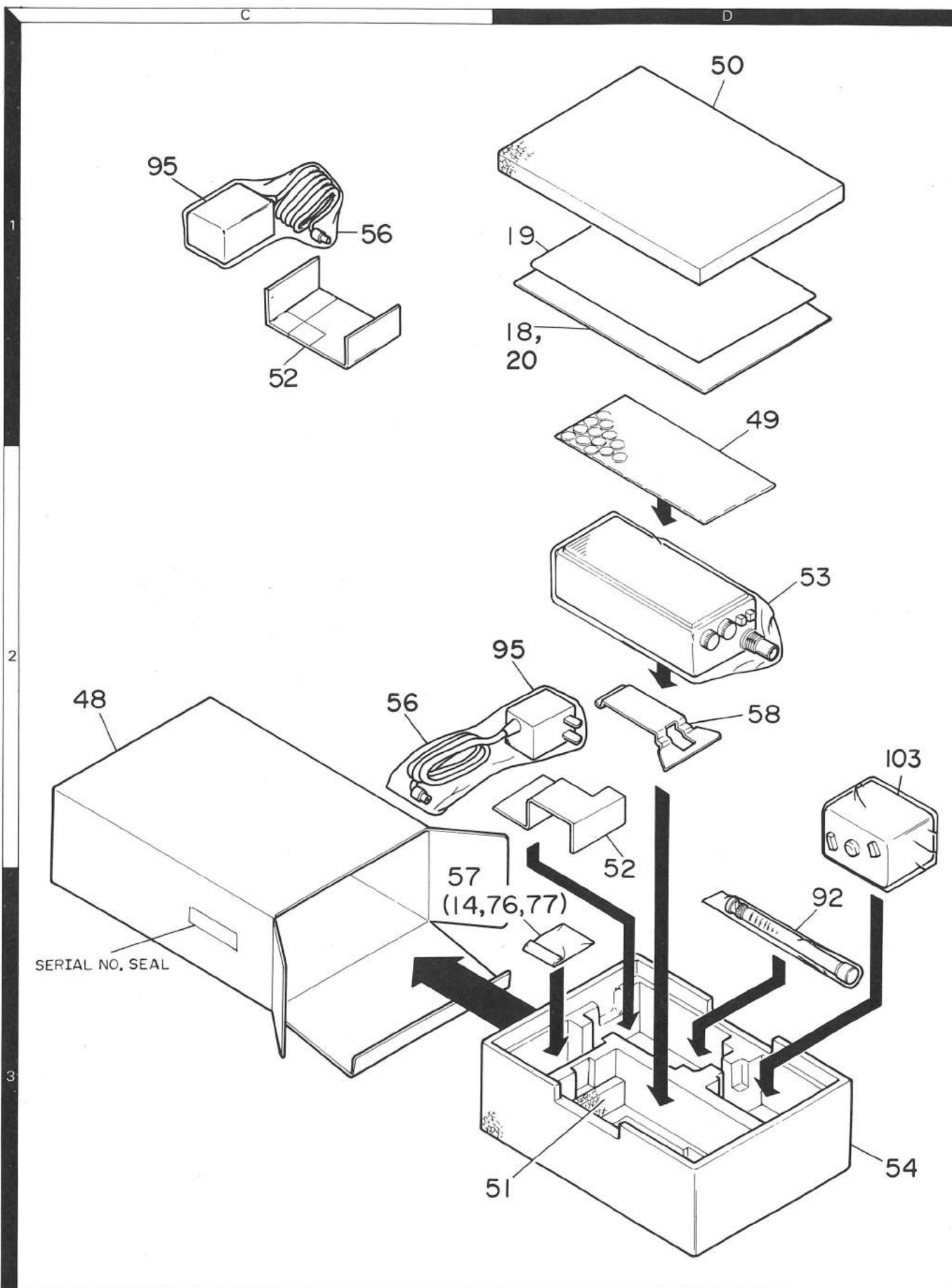
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## EXPLODED VIEW



Parts with the exploded numbers larger than 700 are not supplied.

## PACKING





## ADJUSTMENT

### REQUIRED TEST EQUIPMENT

#### 1. Stabilized Power Supply

- 1) The supply voltage can be changed between 5V and 18V, and the current is 3A or more.
- 2) The standard voltage is 13.8V.

#### 2. DC Ammeter

- 1) Class 1 ammeter (17 ranges and other features)
- 2) The full scale can be set to either 300mA or 10A.
- 3) A cable of less internal loss must be used.

#### 3. Frequency Counter (f. counter)

- 1) Frequencies of up to 1GHz or so can be measured.
- 2) The sensitivity can be changed to 250MHz or below, and measurements are highly stable and accurate ( $10^{-7}$  or so).

#### 4. Power Meter

- 1) Measurable frequency : Up to 500MHz
- 2) Impedance :  $50\Omega$ , unbalanced
- 3) Measuring range : Full scal of 10W or so
- 4) A standard cable (5D2W 1m) must be used.

#### 5. RF VTVM (RF V.M)

- 1) Measurable frequency : Up to 500MHz or so

#### 6. Linear Detector

- 1) Measurable frequency : Up to 500MHz
- 2) Characteristics are flat, and CN is 60dB or more.

#### 7. Digital Voltmeter

- 1) Voltage range : FS = 18V or so
- 2) Input resistance :  $1M\Omega$  or more

#### 8. Oscilloscope

- 1) Measuring range : DC to 30MHz
- 2) Provides highly accurate measurements for 5 to 25 MHz.

#### 9. AF Voltmeter (AF VTVM)

- 1) Measurable frequency : 50Hz to 1MHz
- 2) Maximum sensitivity : 1mV or more

#### 10. Spectrum Analyzer

- 1) Measuring range : DC to 1GHz or more

#### 11. Standard Signal Generator (SSG)

- 1) Maximum frequency : 500MHz or more
- 2) Output :  $-20\text{dB}/0.1\mu\text{V}$  to  $120\text{dB}/1\text{V}$
- 3) Output impedance :  $50\Omega$

#### 12. Tracking Generator

- 1) Center frequency : 50kHz to 200MHz
- 2) Frequency deviation :  $\pm 35\text{MHz}$
- 3) Output voltage : 100mV or more

#### 13. Dummy Load

- 1)  $8\Omega$ , 3W or more

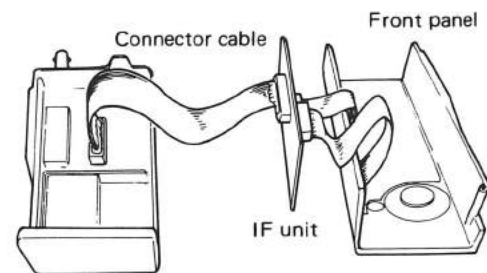
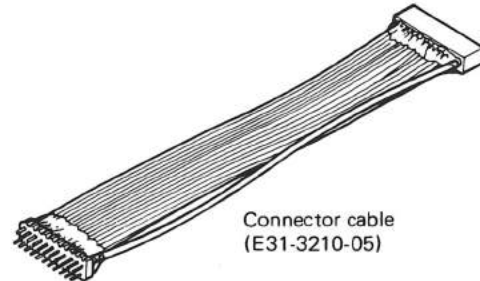
### PREPARATION

- Set the unit in the receiving mode and set the controls as follows, unless otherwise specified.

POWER/VOL .....	ON
SQL VR .....	MIN
F.LOCK .....	OFF
HI/LOW .....	HI

- Use a non-conductive rod such as a Bakelite rod for adjustment (especially of trimmers and coils).
- To protect the SSG, do not send out signals while adjusting the receiving unit.
- The indicated SSG output levels are for maximum output.

### Measuring Jigs



Be careful with the inserting direction when connecting the cables.

## ADJUSTMENT

### TX/RX COMMON ADJUSTMENT

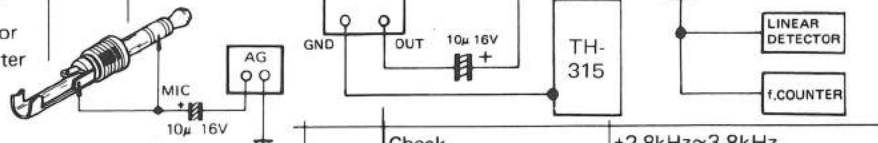
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Voltage check	1) Power supply voltage : 13.8V (DC IN terminal)	DC V.M	IF	CN1-5 (CB)	IF UNIT	C37 C38 C2	LITHIUM BATT MODULUS UNIT	13.1V
	2) C5			CN1-10 (C5)				5.0V
	3) R5			CN1-9 (R5)				4.9V
	4) M5			CN1-24 (M5)				5.0V
	5) T5 PTT : ON			CN1-8 (T5)				4.8V
	6) PTT : OFF							

### PLL ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reference FREQ.	1) FREQ. : 220.02MHz PTT : ON	f.counter Power meter		ANT	RF	TC1	203.12MHz	±100Hz
2. VCV	RX	DC V.M	RF	TP2	RF (VCO PCB)	TC2	3.2V	±0.2V
							Check	2.2V or more.
	TX					TC1	3.1V	±0.2V
							Check	2.0V or more.

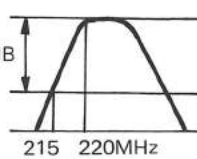
### TX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Power ADJ.	HI	Power meter	ANT terminal	ANT	IF	VR2	5.5W	±0.1W Power consumption : 1.5A or less.
	LOW					VR1	0.5W	
2. DEV.	1) Connect a power meter, linear detector, and f.counter to the ANT terminal FREQ. : 224.98MHz AG output : 1kHz, 80mV PTT : ON	Power meter AG Linear detector f.counter		ANT	IF	VR7	±4.2kHz	±200Hz
	2) AG output : 1kHz, 8mV						Check	
3. TONE	1) FREQ. : 222.50MHz TONE : ON PTT : ON	Power meter Linear detector f.counter			IF	VR8	±0.8kHz	±200Hz
4. DTMF	1) FREQ. : 222.50MHz keyboard : <input checked="" type="checkbox"/> [SAVE] <input checked="" type="checkbox"/> push PTT : ON	Power meter Linear detector f.counter			IF	VR6	DEV. ±3.0kHz	±400Hz
							Check	f : 1633±5Hz
	2) Keyboard : <input checked="" type="checkbox"/> push		Check	DEV. ±0.7kHz~1.7kHz				



## ADJUSTMENT

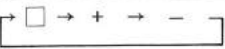
### RX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reception sensitivity	1) Connect a tracking generator to the ANT terminal. Connect a spectrum analyzer to the TP1 terminal of the RF unit.	Tracking generator Spectrum analyzer	RF	ANT TP1	RF	L14 L15~ L17	220MHz MAX. 	The gain and band are MAX.
	2) Connect a SSG to the ANT FREQ. : 221.05MHz SSG output : 70dBμ FREQ. : 187.25MHz MOD : OFF	SSG AF VTVM Oscilloscope	ANT terminal SP terminal	SP	RF	L102	AF output : 1V	Adjust L102 till you get maximum noise output.
	3) SSG output : -8dBμ	DC V.M Distortion meter Oscilloscope AF VTVM	ANT SP	IC7 7P SP	IF RF	L2 L19	MIN. Check	SINAD 12dB or more.
2. S meter	1) FREQ. : 224.98MHz SSG output : -7dBμ	S meter			IF	VR5	Adjust VR5 to the "S-1" reading.	
	2) SSG output : -10dBμ						Check.	Lights OFF.
	3) SSG output : 23dBμ						Check.	All segments light ON.

### Microprocessor operation check

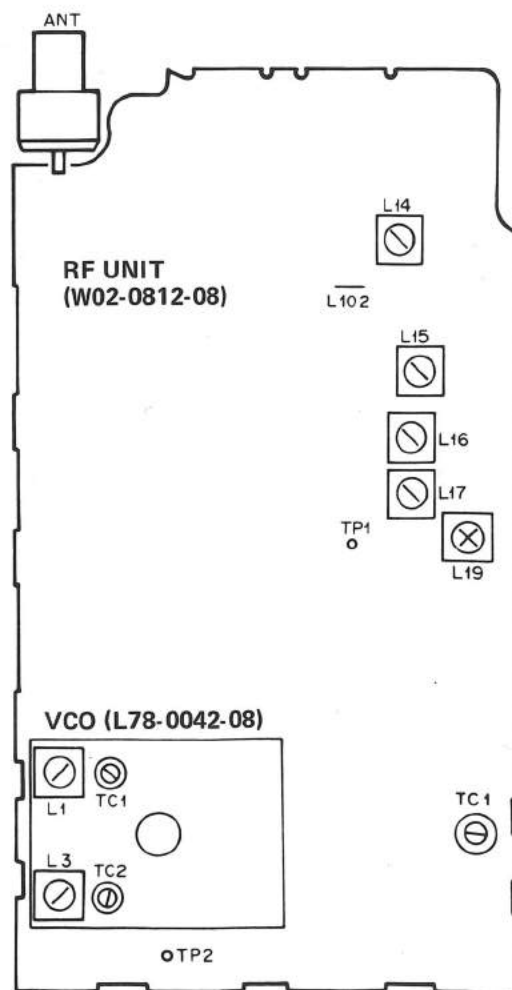
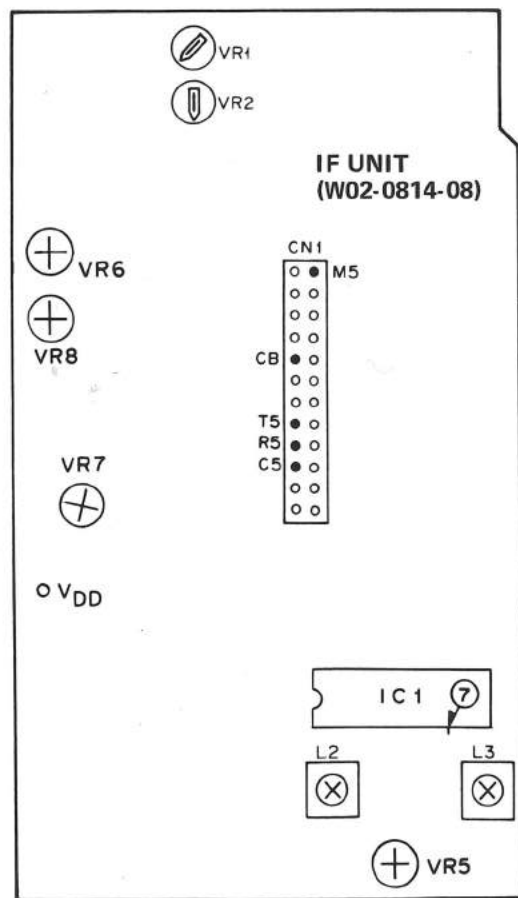
Item	Condition	Operation check	Item	Condition	Operation check
1. FREQ. setting	1) <b>ENTER</b> push	22□.□□□ FREQ. indication : 215.345	2. Function key operation (Pressing <b>F</b> key and numeral key activates the indicated function).	2) <b>F</b> <b>2</b> /BEEP	BEEP ON (except LAMP), BEEP OFF
	<b>1 2 3 4 5</b> push			<b>F</b> <b>2</b> /BEEP	
	2) <b>ENTER</b> push	22□.□□□ FREQ. indication : 226.785		3) <b>F</b> <b>3</b> /STEP	Switching of F.STEP.
	<b>6 7 8 9 0</b> push			4) <b>F</b> <b>4</b> /BAND	<b>BAND</b> indicator turns on. Push <b>SCAN</b> key to start unit scanning on all receivable frequencies.
	3) <b>▼</b> push	5kHz DOWN (when 5kHz steps)	5) <b>F</b> <b>5</b> /MEMORY	<b>MEMO</b> indicator turns on. Push <b>SCAN</b> key to start scan on only the memorized channel.	
	4) <b>▲</b> push	5kHz UP (when 5kHz steps)	6) <b>F</b> <b>6</b> /PROGRAM	<b>PROG</b> indicator turns on. Push <b>SCAN</b> key to start scan between memory 8 and 9.	
2. Function key operation (Pressing <b>F</b> key and numeral key activates the indicated function).	1) <b>F</b> <b>1</b> /PRIORITY	<b>PRI0</b> indicator turns on. Memory channel <b>1</b> is monitored every 5 seconds <b>PRI0</b> indicator blinks if frequency is in use. <b>PRI0</b> indicator turns off.	7) <b>F</b> <b>7</b> /SEEK	<b>SEEK</b> indicator turns on. Push <b>SCAN</b> key to start scanning. If a signal is detected stops scanning and the scanning operation is released.	
	<b>F</b> <b>1</b> /PRIORITY		8) <b>F</b> <b>8</b> /TIME	<b>TIME</b> indicator turns on. Push <b>SCAN</b> key to start scanning. Scanning stops if signal detected, and scanning restarts after 5 seconds.	

## ADJUSTMENT

Item	Condition	Operation check
2. Function key operation (Pressing <b>F</b> key and numeral key activates the indicated function).	9) <b>F</b> <b>9</b> /CARRIER	<b>CAR</b> indicator turns on. Push <b>SCAN</b> key to start scanning. Scanning stops if signal detected, and scanning restarts 2 seconds after the signal ends.
	10) <b>F</b> <b>▲</b> or <b>▼</b>	High speed operation of <b>▼</b> or <b>▲</b> mode.
	11) <b>F</b> <b>M</b> /TX STOP <b>F</b> <b>M</b> /TX STOP	<b>TX STOP</b> indicator turns on. PTT and TONE key are disabled. <b>TX STOP</b> indicator turns off.
	12) <b>F</b> <b>ENTER</b> /KEY LOCK <b>F</b> <b>ENTER</b> /KEY LOCK	<b>KEY LOCK</b> indicator turns on. Disables all keys except KEY LOCK and LAMP. <b>KEY LOCK</b> indicator turns off.
3. OFFSET	1) <b>OFFSET/F</b>	
4. Memory	1) <b>FREQ.</b> indication : 220.02 <b>M</b> <b>I</b> push	<b>M</b> <b>I</b> indicator turns on.
	2) <b>FREQ.</b> indication : Any value <b>I</b> push	<b>I</b> indicator turns on. <b>FREQ.</b> indication : 220.02

Item	Condition	Operation check
5. BATT SAVE	1) <b>SQ</b> : ON	The SAVE circuit begins operation after about 2 seconds.
	2) <b>SAVE</b> push	
	3) <b>F</b> <b>SAVE</b> <b>▲</b> or <b>▼</b> <b>ENTER</b>	A rate from 1 to 9 can be selected.
6. BATT Warning	1) Unit monitors 7V from BATT pin.	<b>BATT</b> indicator remains off.
	2) Unit monitors 5.5V from BATT pin.	<b>BATT</b> indicator turns on.
7. R/ TONE.F	1) <b>R/TONE.F</b> push	R indicator turns on.
	push	R indicator turns off.
	2) <b>F</b> <b>R/TONE.F</b>	
	3) Set frequency with <b>▲</b> or <b>▼</b> .	
4) <b>ENTER</b> push	Complete TONE frequency setting.	
8. RESET	1) <b>POWER</b> : OFF	Unit is reset. <b>FREQ.</b> indication : 220.000
	2) Hold down <b>F</b> <b>ENTER</b> <b>POWER</b> : ON	

### Adjusting points

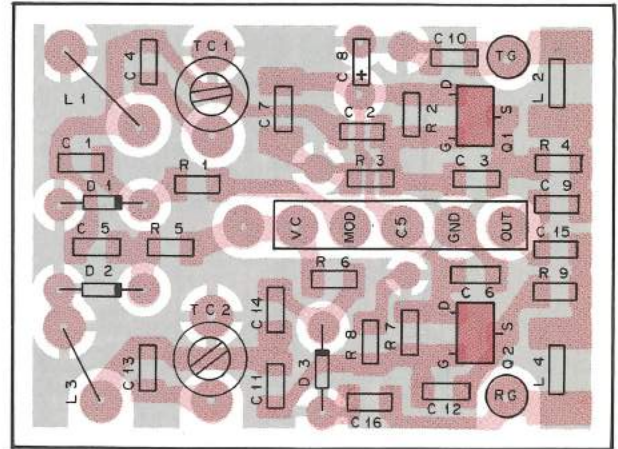


# TERMINAL FUNCTIONS/PC BOARD VIEWS TH-315A

## Terminal functions

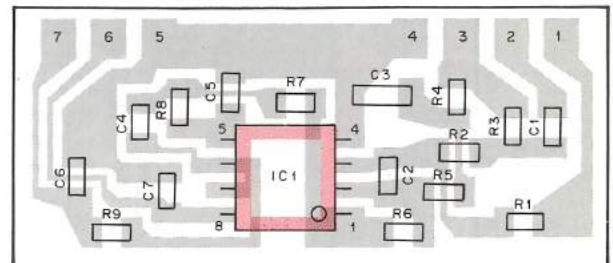
Terminal		Terminal function	
No.	Name		
<b>IF/RF UNIT COMMON</b>			
1	B	Power supply before Power switch ON.	
2	B	Power supply before Power switch ON.	
3	GND	Ground	
4	CB	Power supply after Power switch ON.	
5	CB	Power supply after Power switch ON.	
6	AFO	AF output line	
7	H/L	transmission/reception output control line	
8	T5	5V for transmission	
9	R5	5V for reception	
10	C5	5V for transmission/reception common	
11	GND	Ground	
12	MOD	Modulation signal line	
13	IF	Reception IF signal	
14	GND	Ground	
15	RST	PLL IC reset pulse	
16	SI	PLL IC serial data pulse	
17	CPS	PLL IC clock pulse	
18	UL	Unlock line, "L" : LOCK, "H" : UNLOCK	
19	SP	Signal line to internal speaker	
20	AFG	AF output line ground	
21	MIC	Signal line from Microphone	
22	IM	Signal line from internal microphone	
23	ST	Standby switch, "H" : transmission, "L" : reception	
24	M5	5V for Microphone	
<b>RF UNIT (W02-0812-08)</b>			
1	-	Battery (-)	
2	+	Battery (+)	
<b>IF UNIT (W02-0814-08)</b>			
CN2	1	TS	Tone SW ON "L"
	2	BEEP	BEEP input
	3	ST	Standby SW "L" : transmission
	4	IM	Signal line from internal MIC
	5	AFG	AF output GND
	6	SP	Signal line to internal SP
	7	UL	Unlock line, "L" : LOCK, "H" : UNLOCK
	8	CPS	PLL IC clock pulse
	9	SI	PLL IC serial data pulse
	10	RST	PLL IC reset pulse
	11	TRS	Tone IC clock pulse
	12	TDA	Tone IC data pulse
	13	TCK	Tone IC clock pulse
	14	GND	Ground
	15	SM	S meter data output
CN3	1	TCK	Tone IC clock pulse
	2	TDA	Tone IC data pulse
	3	TRS	Tone IC reset pulse
	4	TB	Power supply for external Tone unit
	5	SPO	AF output control line
	6	TI	Tone input line
	7	GND	Ground
CN4	1	SAVE	Battery save control line
	2	KEY	Power supply for key matrix
	3	VDD	Power supply for MPU
	4	TX	T5/R5 select line, "H" : transmission
	5	SQ	BUSY detect line, "H" : BUSY
	6	CB	Power supply after Power SW ON
	7	BU	Backup control line
	8	AFC	AF output control line "H" : BUSY
	9	TONE	SUB Tone signal input line
	10	DTMF	DTMF signal input line

VCO (L78-0042-08) Component side view



Q1,2 : 2SK210(GR) D1-3 : 1SV153

MIC AMP (X59-3090-10) Component side view

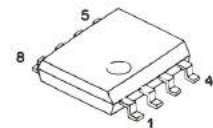


IC1 : NJM4560M

2SK210

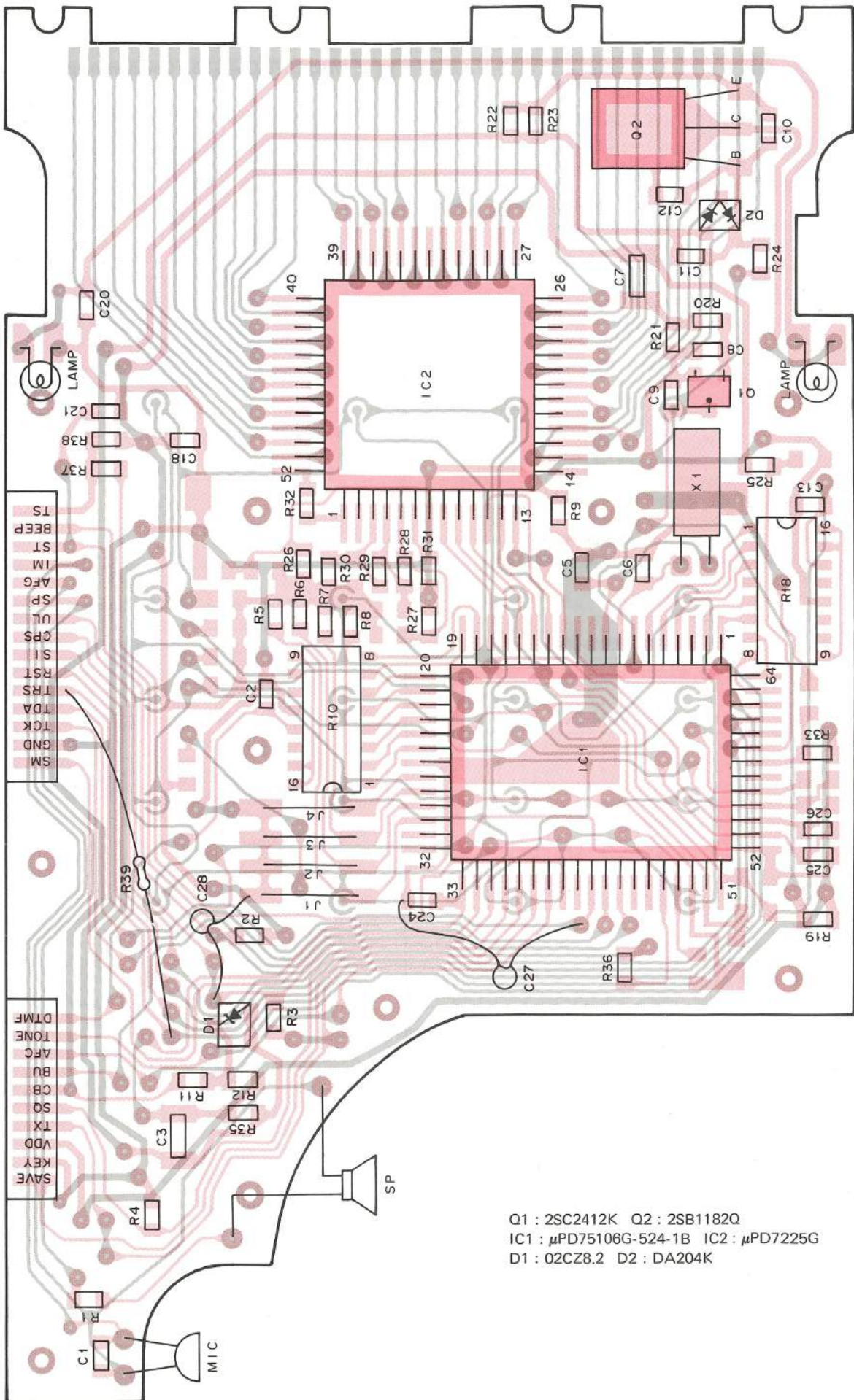


NJM4560M



# TH-315A PC BOARD VIEW

CASE ASS'Y (A02-0842-05) Component side view

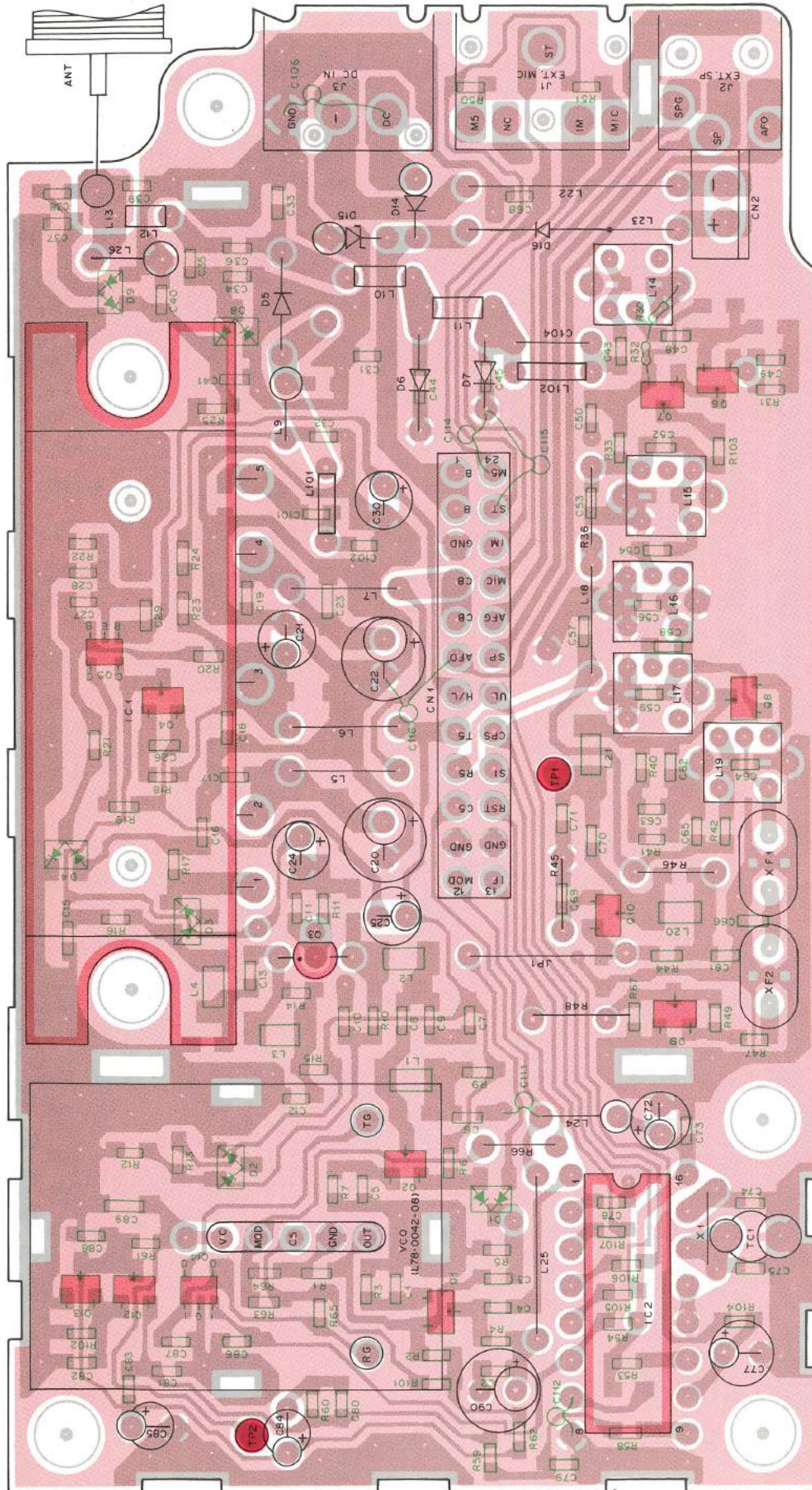


SM  
GND  
TCK  
TDA  
TRST  
TRST  
S1  
CPS  
UL  
SP  
AFG  
IM  
ST  
BEEP  
TS

SAVE  
KEY  
VDD  
TX  
SQ  
CB  
BU  
AFC  
TONE  
DTMF

Q1 : 2SC2412K Q2 : 2SB1182Q  
 IC1 :  $\mu$ PD75106G-524-1B IC2 :  $\mu$ PD7225G  
 D1 : 02CZ8.2 D2 : DA204K

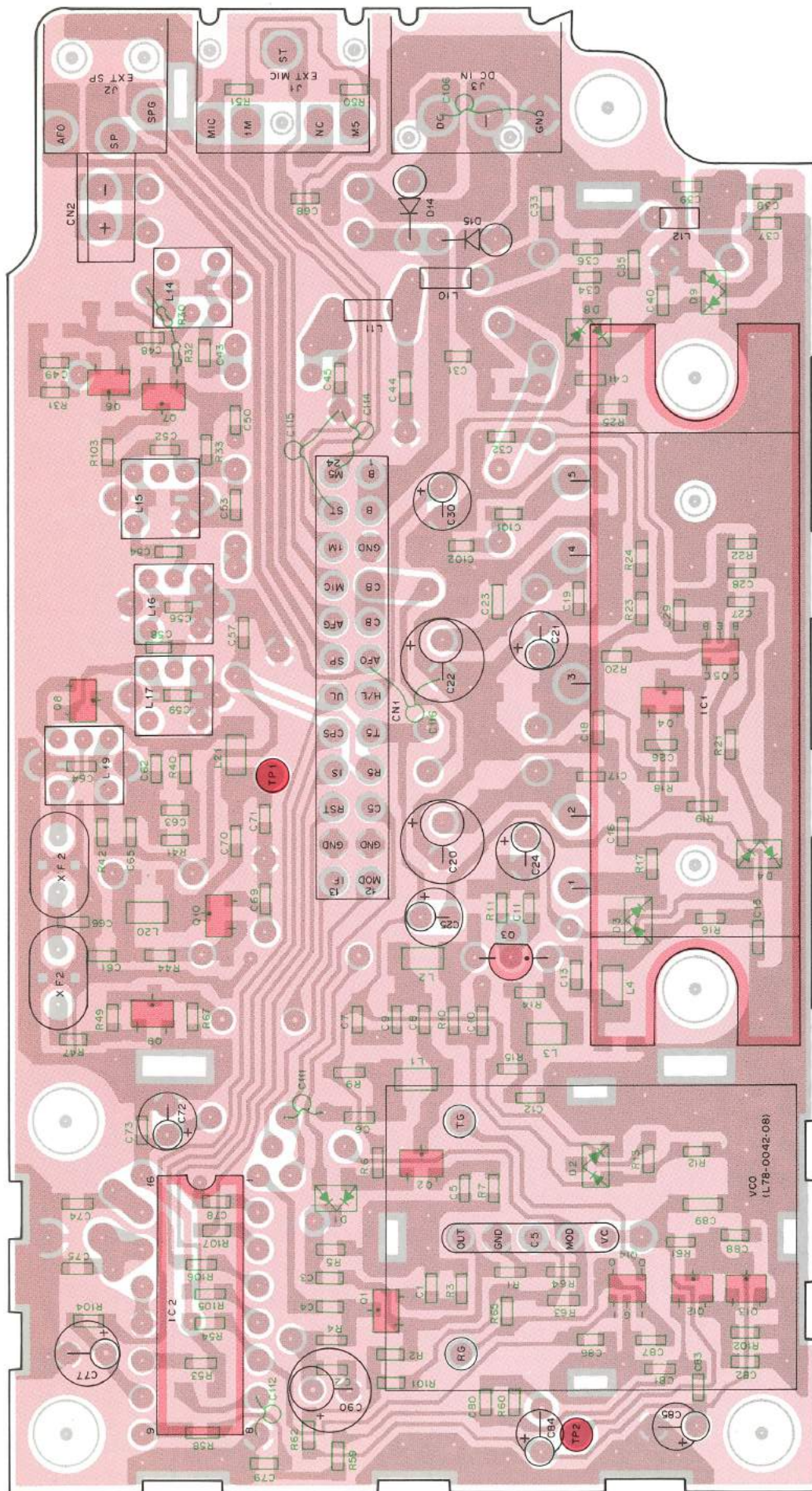
RF UNIT (W02-0812-08) Component side view



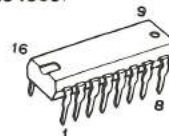
Q1,7,9 : 2SC2714(O) Q2,10 : 2SC338K(N,P) Q3 : 2SC2407 Q4 : 2SA1313(Y) Q5 : FMW1 Q6 : 2SC3356 Q8 : 2SK210(GR) Q12,13 : 2SC2712(GR) Q14 : FMG4  
 IC1 : M67723 IC2 : M54959P  
 D1 : DAN235K D2,4 : DA204K D3 : 1SV172 D5 : MI303 D6 : MI303 D7 : 1SS277 D8,9 : HSM88AS D14,16 : ERB83-004 D15 : UZP-22B

# PC BOARD VIEWS TH-315A

RF UNIT (W02-0812-08) Foil side view



M54959P



2SA1313 2SC3356  
2SC2412K 2SC3838K  
2SC2712  
2SC2714



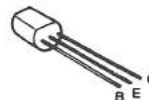
FMW1  
FMG4



2SJ106



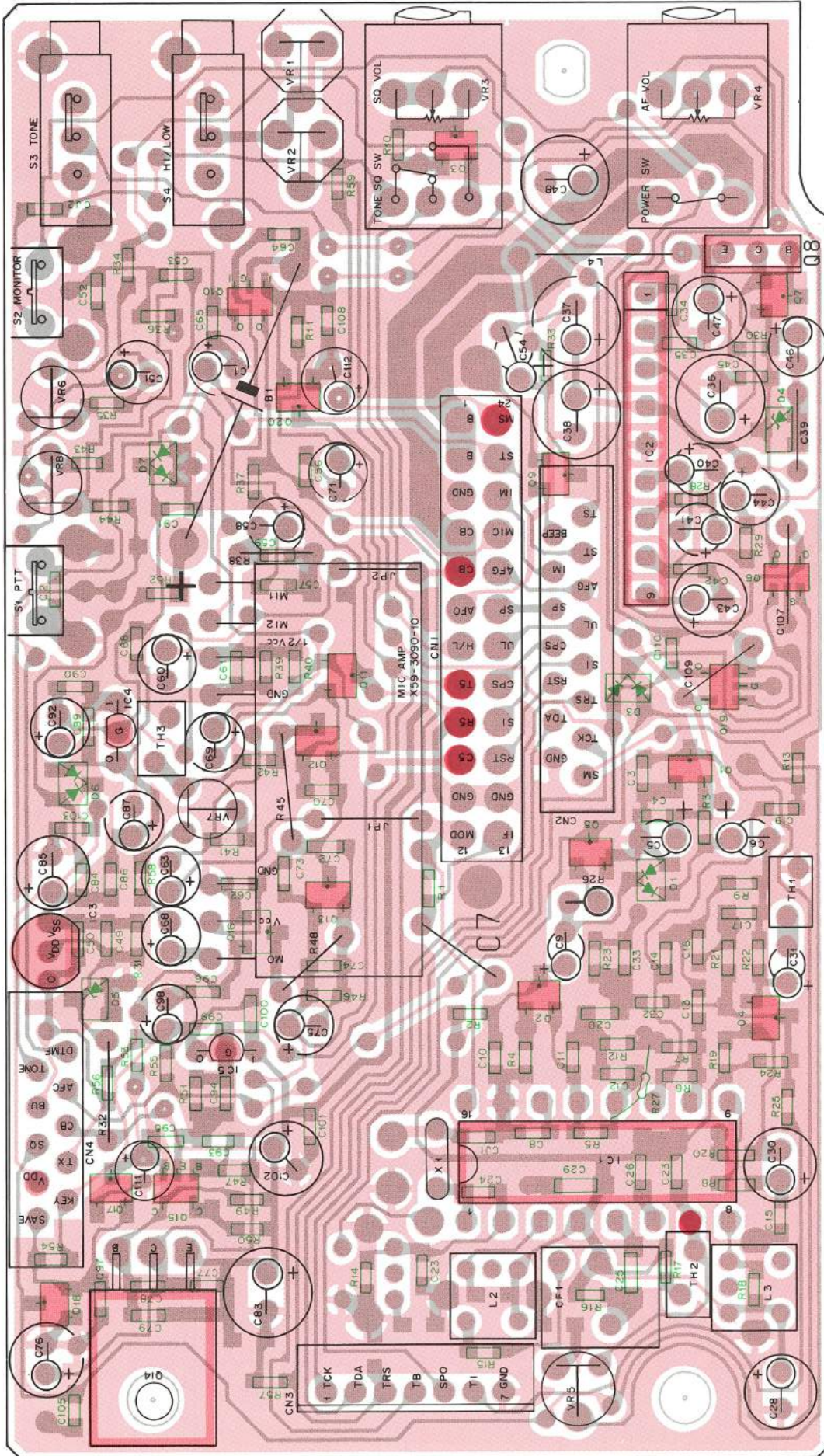
2SC2407





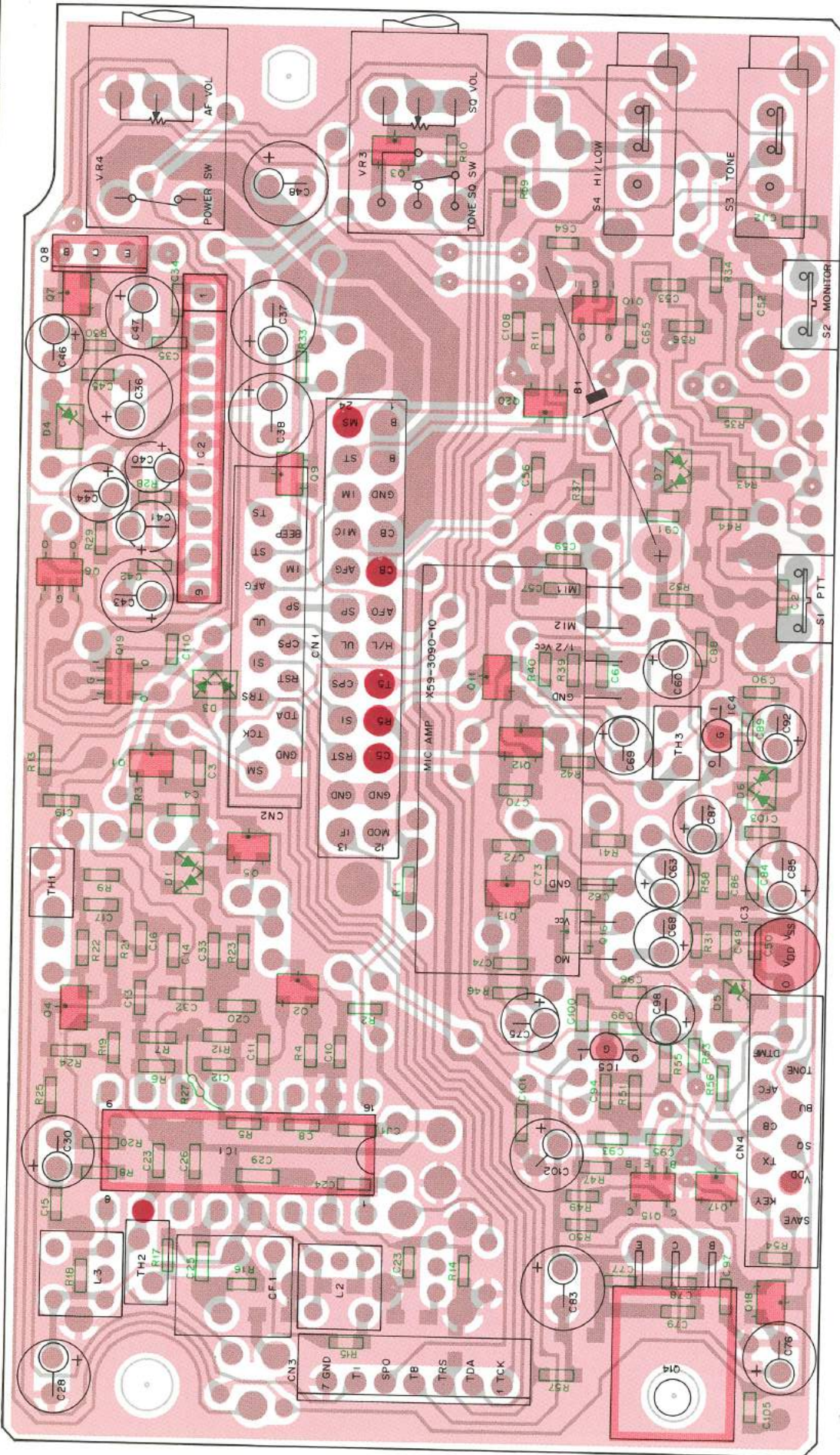
# TH-315A PC BOARD VIEWS

IF UNIT (W02-0814-08) Component side view

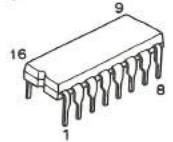


Q1,2,4,7 : 2SC2712(Y) Q3,20 : DTC144EK Q5 : 2SJ106(GR) Q6,10,19 : FMG2 Q8 : 2SA1241(Y) Q9 : DTC143XK Q11 : DTA143ZK  
 Q12 : DTA144EK Q13 : 2SA1313(Y) Q14 : 2SA1358(Y) Q15 : FMW1 Q16-18 : DTC114YK  
 IC1 : TA7761P IC2 : BA526 IC3 : S-8054HN IC4,5 : LP2950CZ  
 D1 : HSM88AS D3,6 : 1SS184 D4 : 02CZ7.5Y D5 : 02CZ8.2 D7 : 1SS226  
 TH1 : PTH59T103M TH2 : 112-202-2 YH3 : 112-101-2

IF UNIT (W02-0814-08) Foil side view



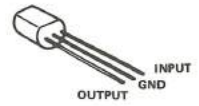
TA7761P



BA526



LP2950CZ  
S-8054HN



2SJ106



2SA1313  
2SC2712



2SA1241



DTC114YK  
DTC143XK  
DTC144EK



DTA143ZK  
DTA144EK



2SA1358



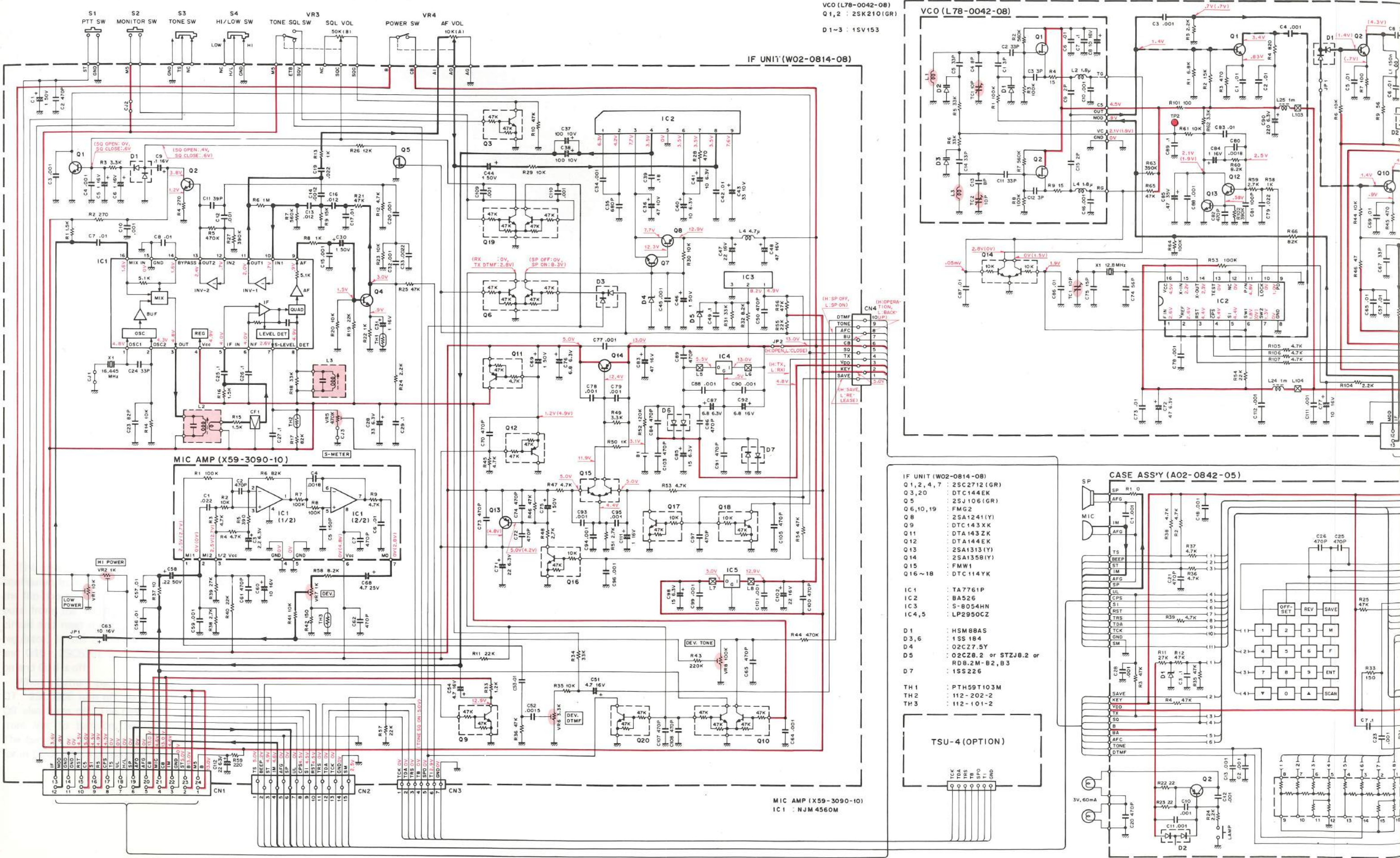
FMG2  
FMW1



Signal line — Control line — Common DC line

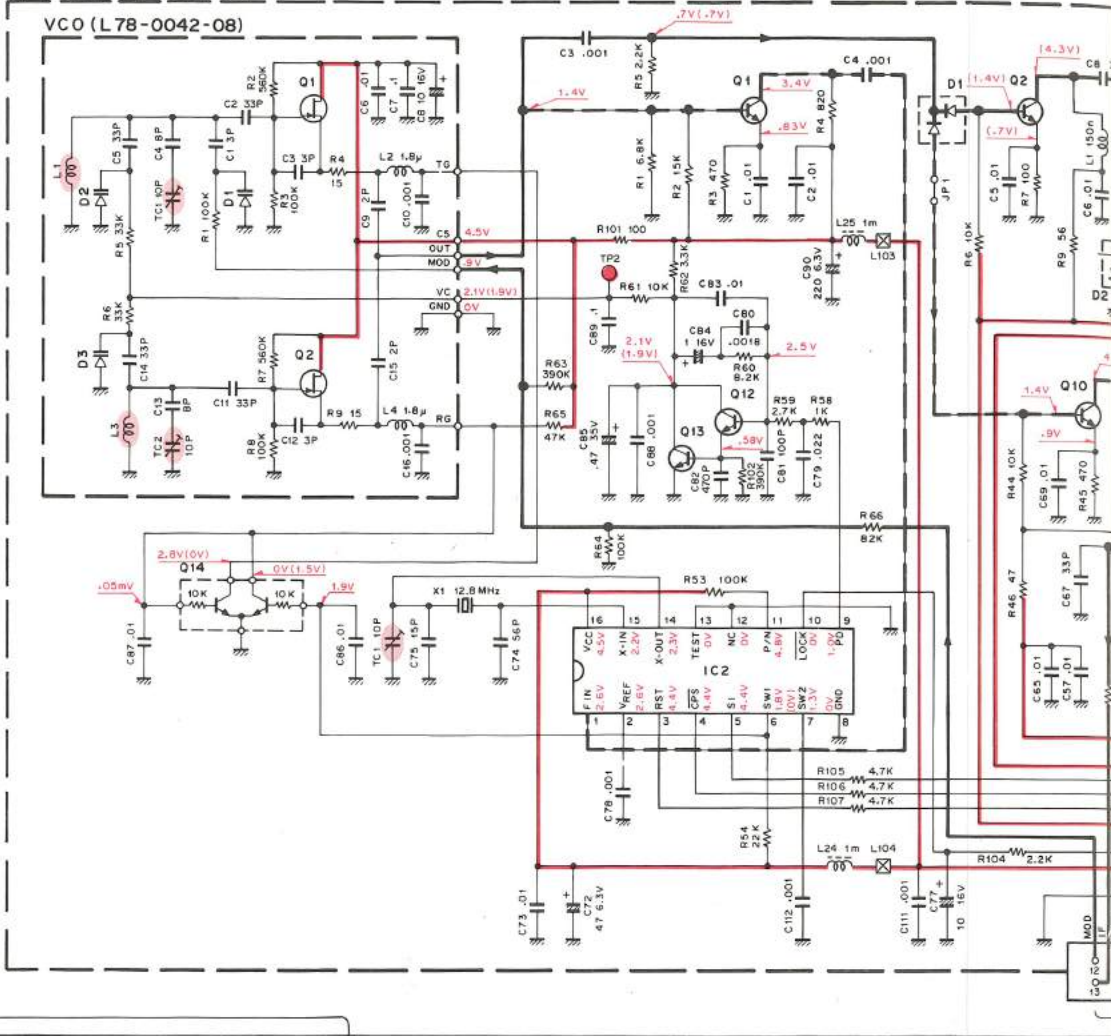
# SCHEMATIC DIAGRAM

Voltage mea

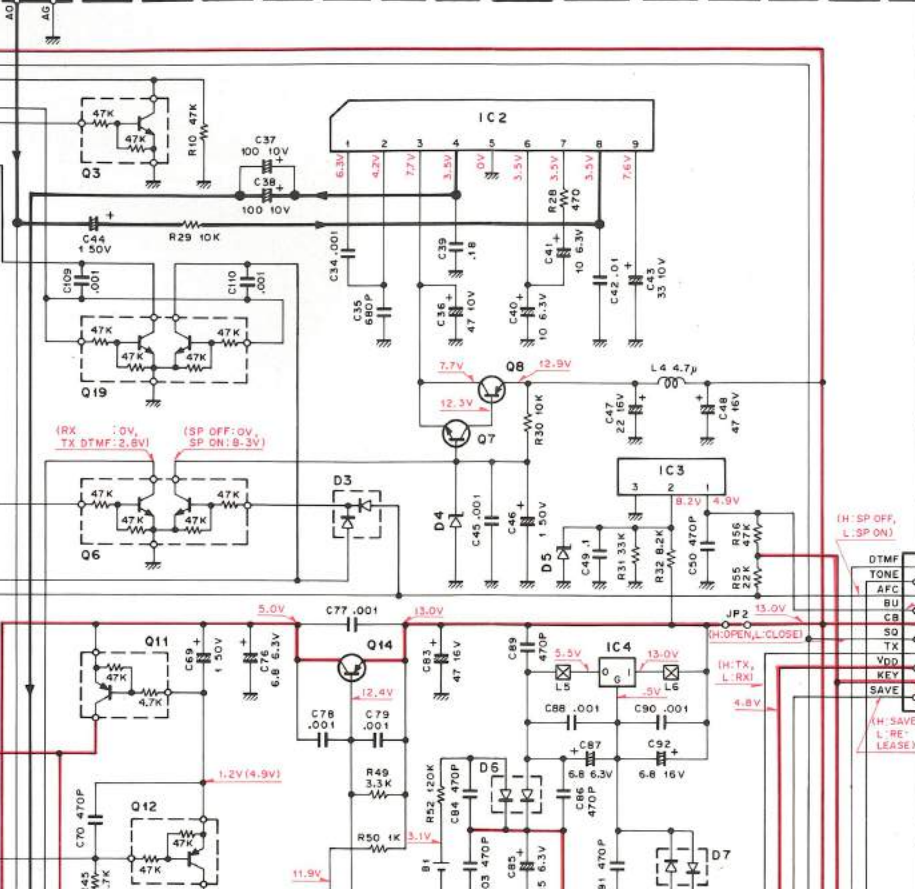


VCO (L78-0042-08)  
 Q1,2 : 2SK210(GR)  
 D1-3 : 1S153

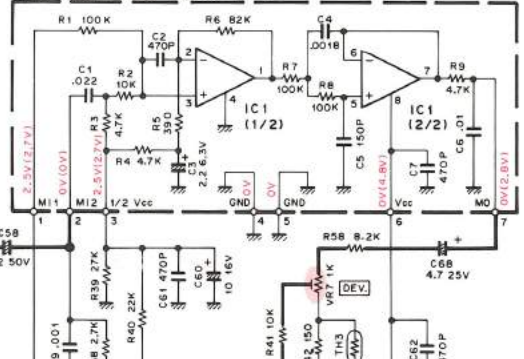
## RF UNIT (W02-0812-08)



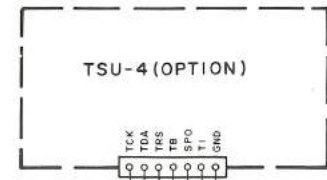
## IF UNIT (W02-0814-08)



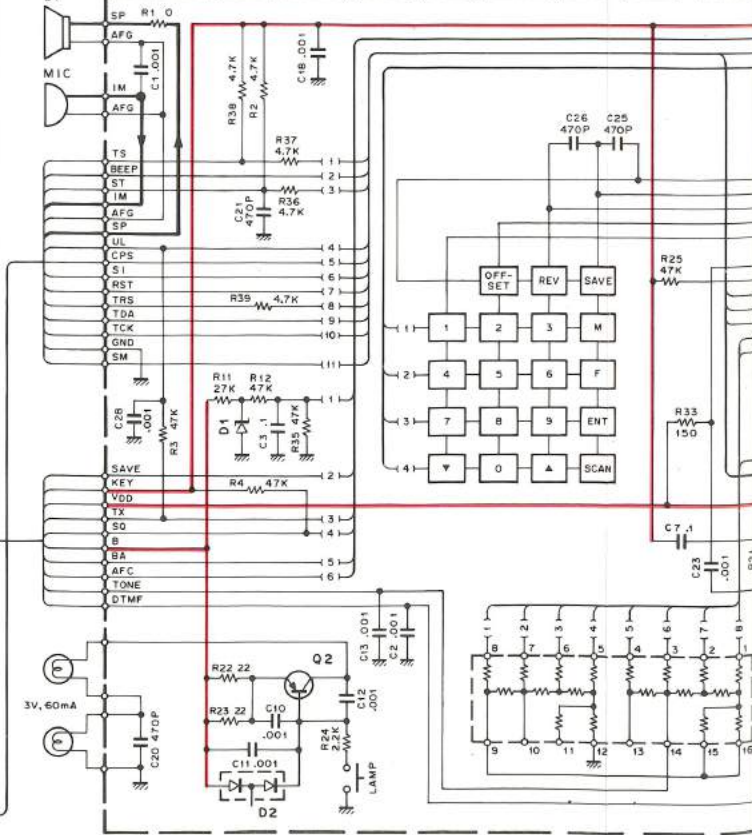
## MIC AMP (X59-3090-10)



- IF UNIT (W02-0814-08)  
 Q1,2,4,7 : 2SC2712(GR)  
 Q3,20 : DTC144EK  
 Q5 : 2SJ106(GR)  
 Q6,10,19 : FMG2  
 Q8 : 2SA1241(Y)  
 Q9 : DTC143XK  
 Q11 : DTA143ZK  
 Q12 : DTA144EK  
 Q13 : 2SA1313(Y)  
 Q14 : 2SA1358(Y)  
 Q15 : FMW1  
 Q16~18 : DTC114YK
- IC1 : TA7761P  
 IC2 : BA526  
 IC3 : S-8054HN  
 IC4,5 : LP2950CZ
- D1 : HSM88AS  
 D3,6 : 1SS184  
 D4 : 02CZ7.5Y  
 D5 : 02CZ8.2 or STZJ8.2 or RDB.2M-B2,B3  
 D7 : 1SS226
- TH1 : PTH59T103M  
 TH2 : 112-202-2  
 TH3 : 112-101-2



## CASE ASS'Y (A02-0842-05)



MIC AMP (X59-3090-10)  
 IC1 : NJM4560M

# SCHEMATIC DIAGRAM

Voltage measurement conditions f = 220.020MHz, Vcc = 8.4V, ( ) : TX

# TH-315A

VCO (L78-0042-08)  
Q1,2 : 2SK210(GR)  
D1~3 : 1S153

RF UNIT (W02-0812-08)

IF UNIT (W02-0814-08)

VCO (L78-0042-08)

IF UNIT (W02-0814-08)

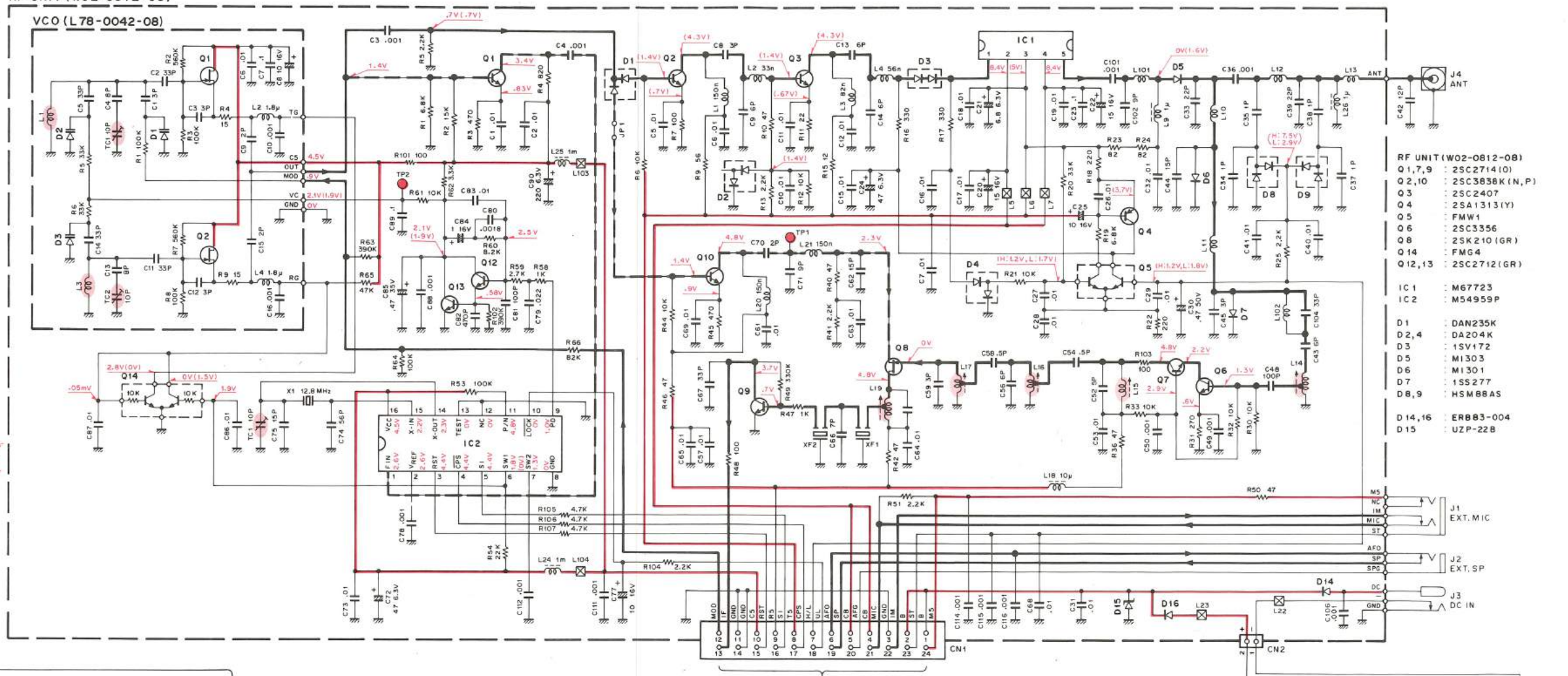
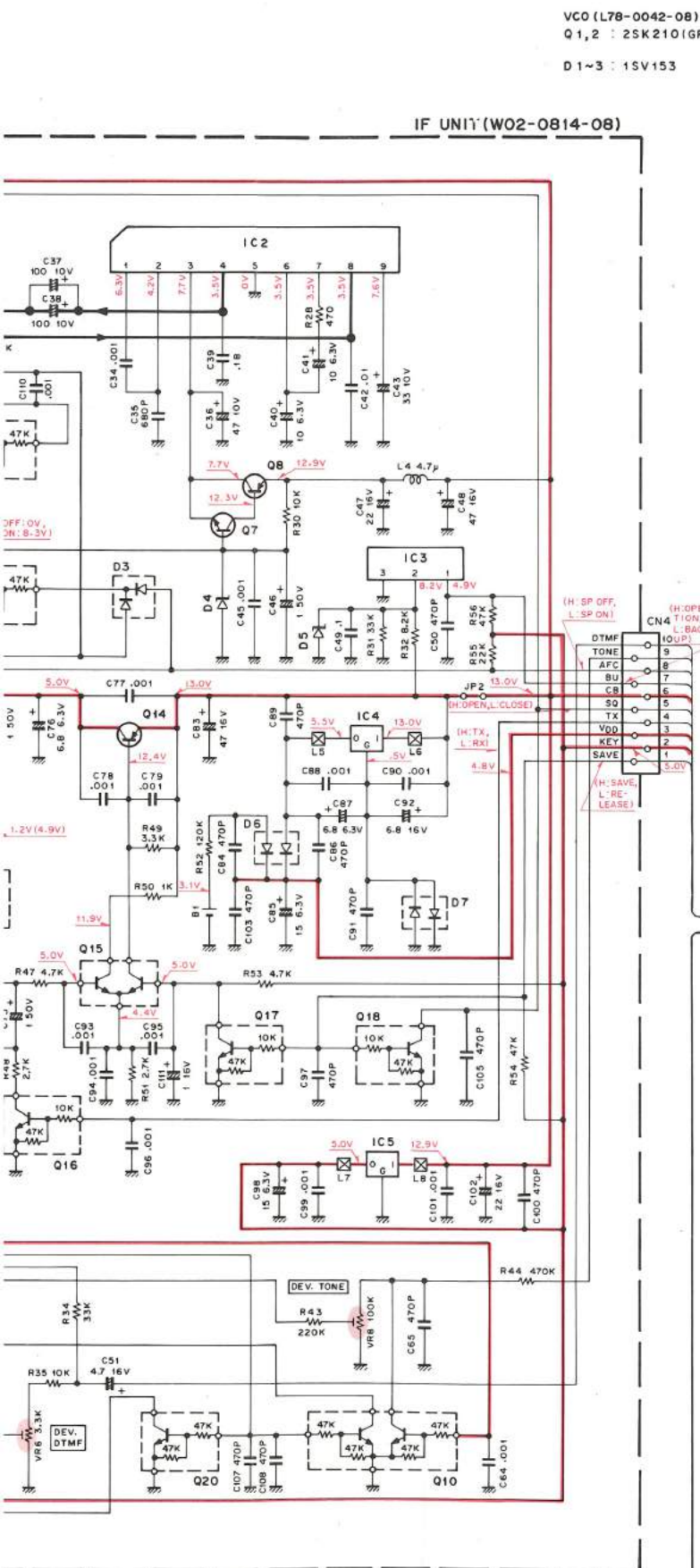
CASE ASS'Y (A02-0842-05)

- Q1, 2, 4, 7 : 2SC2712 (GR)
- Q3, 20 : DTC144EK
- Q5 : 2SJ106 (GR)
- Q6, 10, 19 : FMG2
- Q8 : 2SA1241 (Y)
- Q9 : DTC143 XK
- Q11 : DTA143 ZK
- Q12 : DTA144 EK
- Q13 : 2SA1313 (Y)
- Q14 : 2SA1358 (Y)
- Q15 : FMW1
- Q16 ~ 18 : DTC114 YK
- IC1 : TA7761P
- IC2 : BA526
- IC3 : S-8054HN
- IC4, 5 : LP2950CZ
- D1 : HSM88AS
- D3, 6 : 1SS184
- D4 : 02C27.5Y
- D5 : 02C28.2 or STZJ8.2 or RDB.2M-82, B3
- D7 : 1SS226
- TH1 : PTH59T103M
- TH2 : 112-202-2
- TH3 : 112-101-2

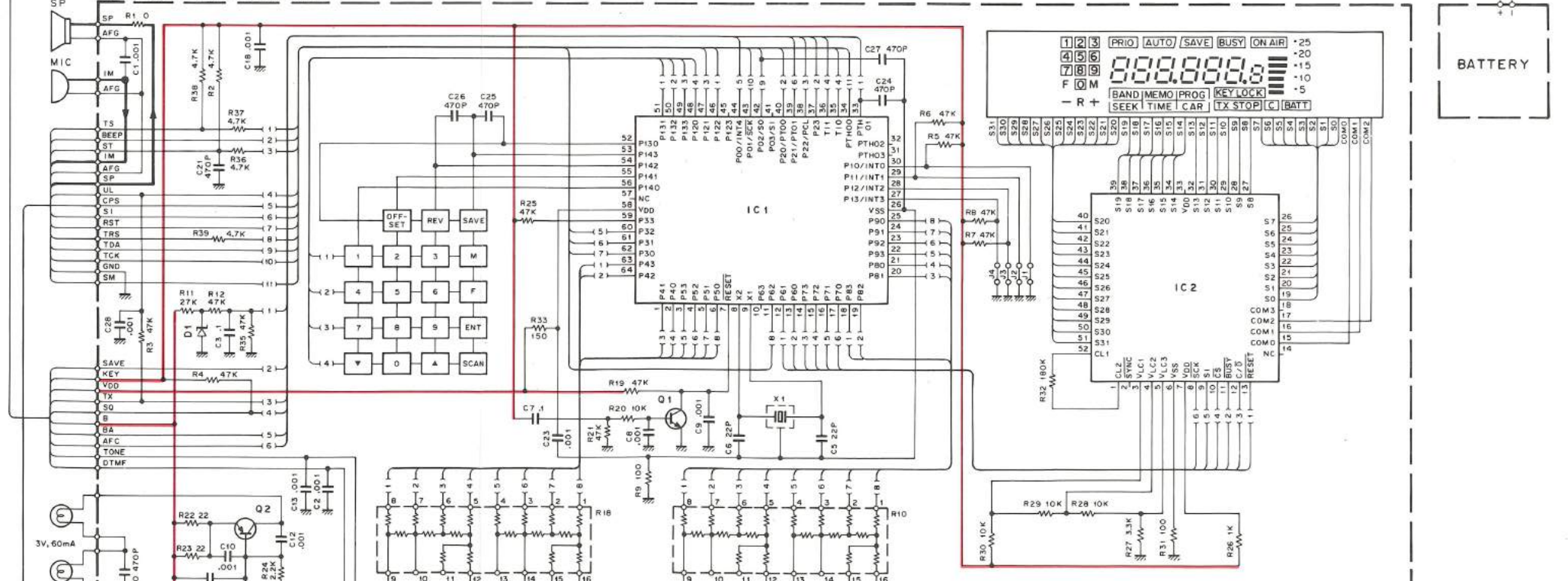
TSU-4 (OPTION)

MIC AMP (X59-3090-10)  
IC1 : NJM4560M

Q1 : 2SC2412K IC1 : μPD751066-524-1B D1 : 02C28.2  
Q2 : 2SB1182Q IC2 : μPD7225G D2 : DA204K

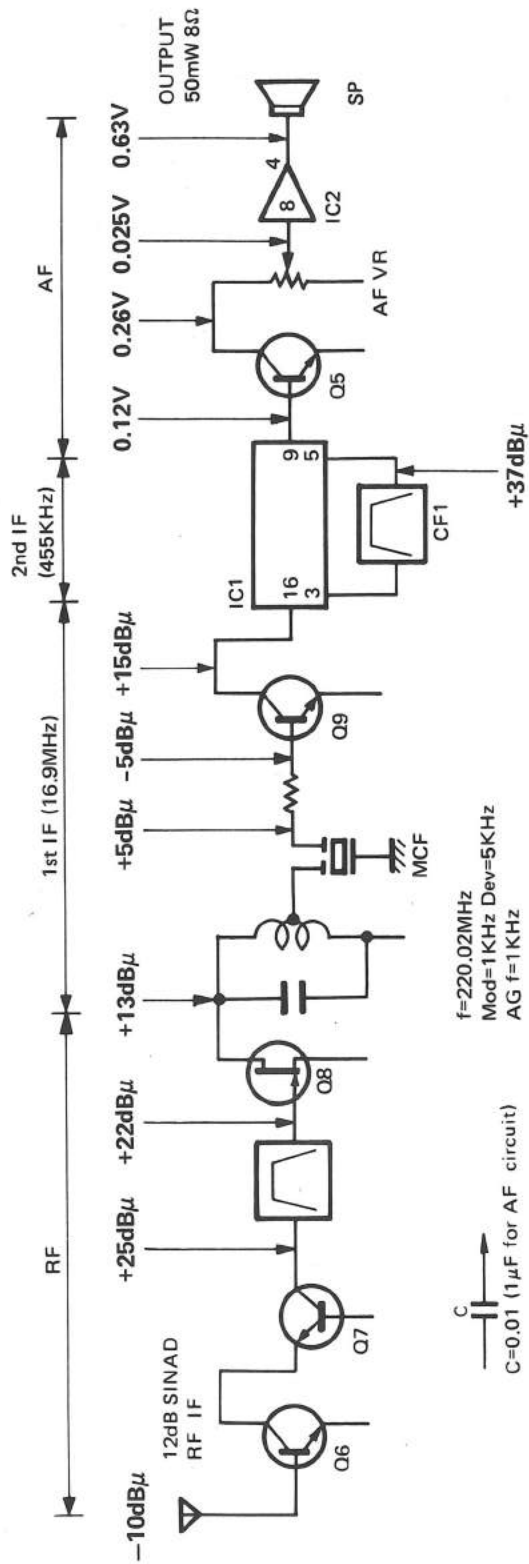


- RF UNIT (W02-0812-08)
- Q1, 7, 9 : 2SC2714 (O)
- Q2, 10 : 2SC3838K (N, P)
- Q3 : 2SC2407
- Q4 : 2SA1313 (Y)
- Q5 : FMW1
- Q6 : 2SC3356
- Q8 : 2SK210 (GR)
- Q14 : FMG4
- Q12, 13 : 2SC2712 (GR)
- IC1 : M67723
- IC2 : M54959P
- D1 : DAN235K
- D2, 4 : DA204K
- D3 : 1SV172
- D5 : MI303
- D6 : MI301
- D7 : 1SS277
- D8, 9 : HSM88AS
- D14, 16 : ERB83-004
- D15 : UZP-22B

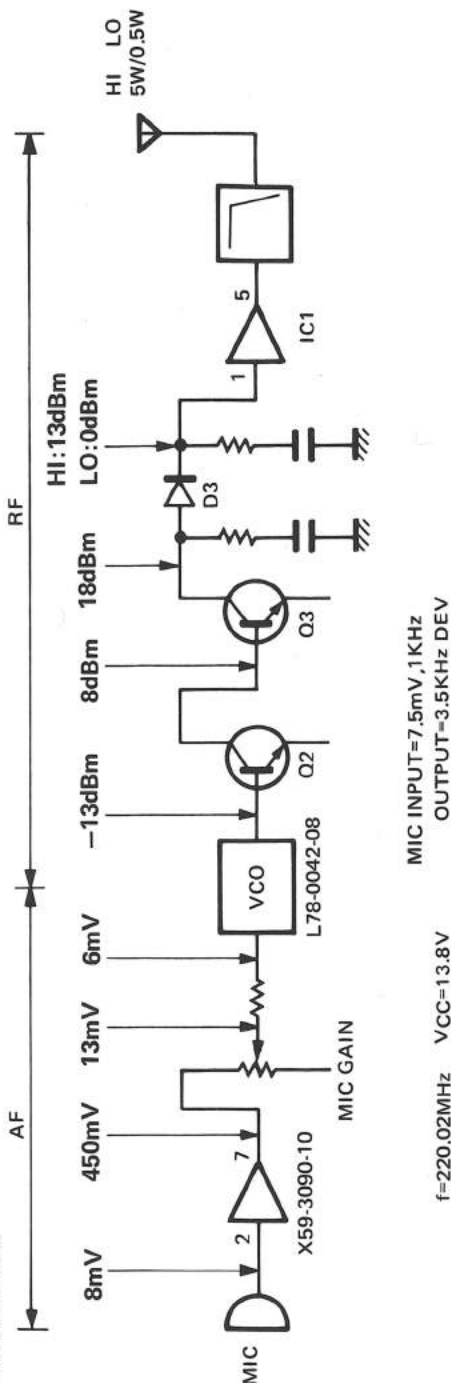


## LEVEL DIAGRAM

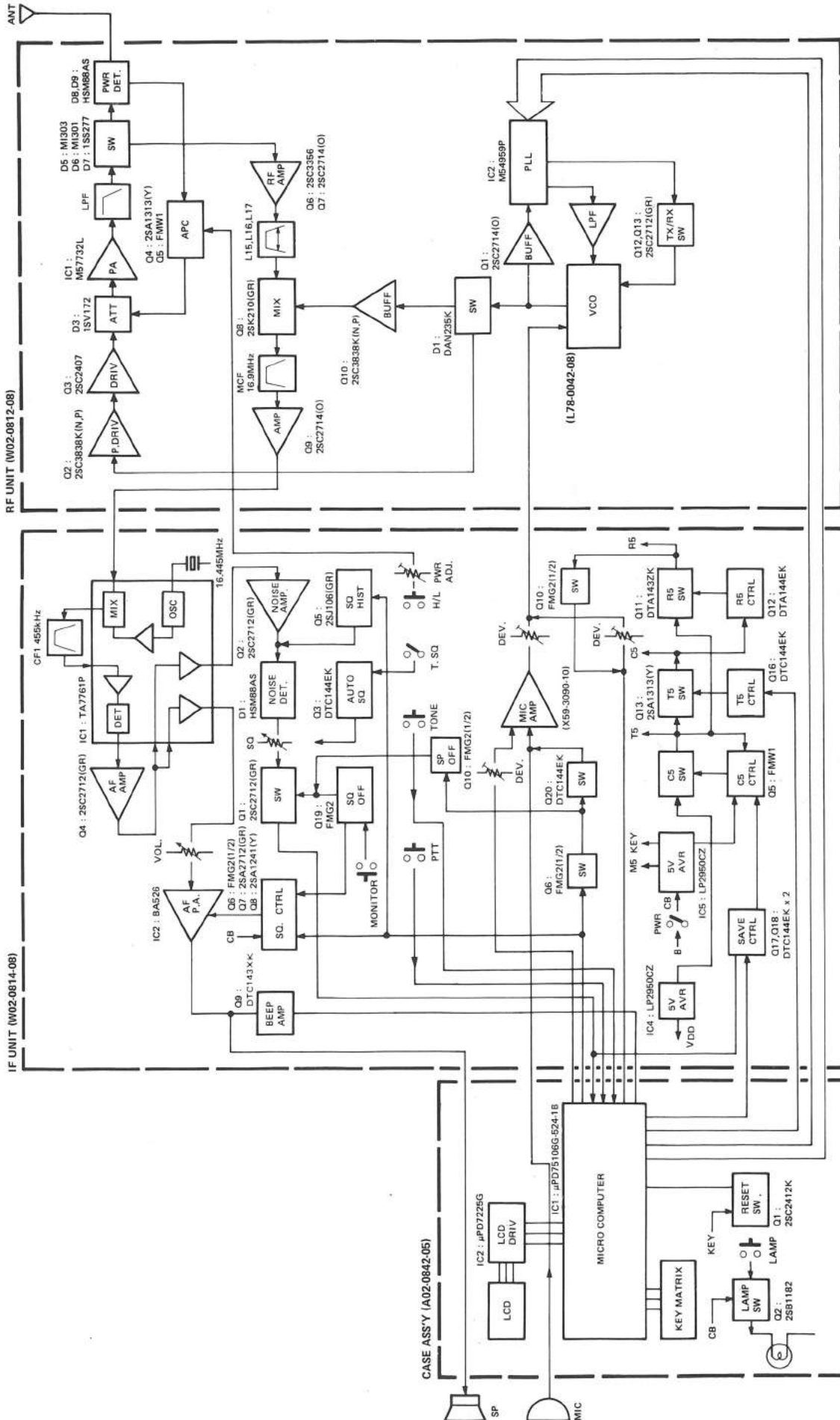
### TX SECTION



### RX SECTION



BLOCK DIAGRAM



## BC-7 (RAPID CHARGER)

### BC-7 External View



### BC-7 Circuit Description

#### General

The BC-7 is a rapid charger for the PB-1 to PB-4 Ni-Cd batteries for the TH-205, TH-215, TH-405, TH-415 and TH-315.

### 2) Battery Pack Detect Circuit

This circuit detects whether a battery pack is inserted in the charger. Outputs from this circuit are routed to the reset circuit and the battery recognition circuit.

When a PB-3 or PB-4 is inserted in the charger, a small amount of current flows from Q2 : 2SA608E through R9 to the charging terminal B1 and Q2 turns on. As a result,

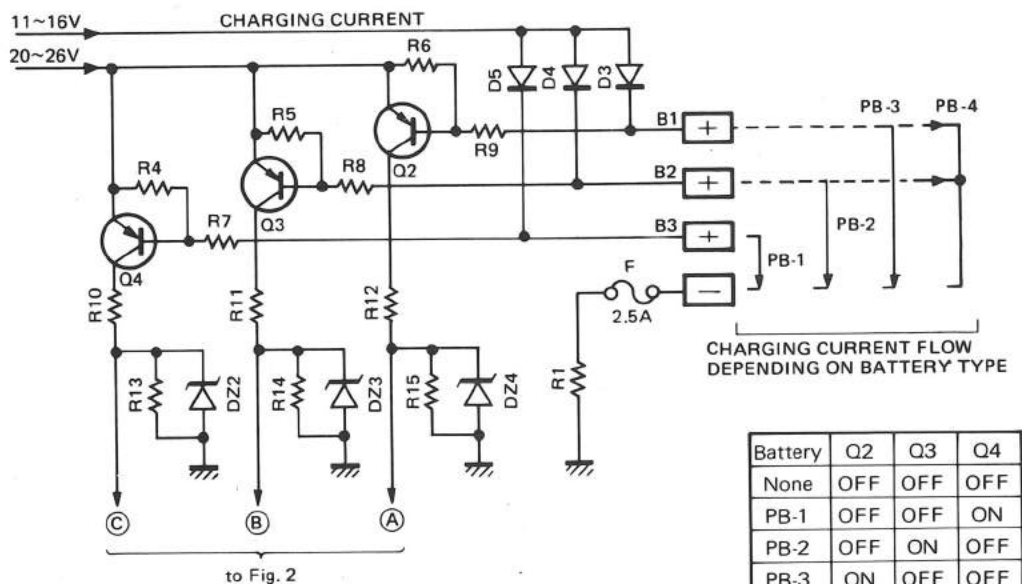
### Theory of Operation

The operation of each block is explained below.

#### 1) + 11V AVR Circuit

This AVR circuit, consisting of a 2SD600F transistor (Q1) and DZA11Y Zener diode (DZ1) provides an output of approximately +11V as the reference voltage for the charging circuit consisting of IC2 to IC5.

an output of approximately 11V appears at (A) in Figure 1. Similarly when a PB-2 or PB-4 is inserted Q3 : 2SA608E turns on and approximately 11V is provided at output (B). When a PB-1 is inserted Q4 : 2SA608E turns on and approximately 11V is provided at output (C).



Battery	Q2	Q3	Q4
None	OFF	OFF	OFF
PB-1	OFF	OFF	ON
PB-2	OFF	ON	OFF
PB-3	ON	OFF	OFF
PB-4	ON	ON	OFF

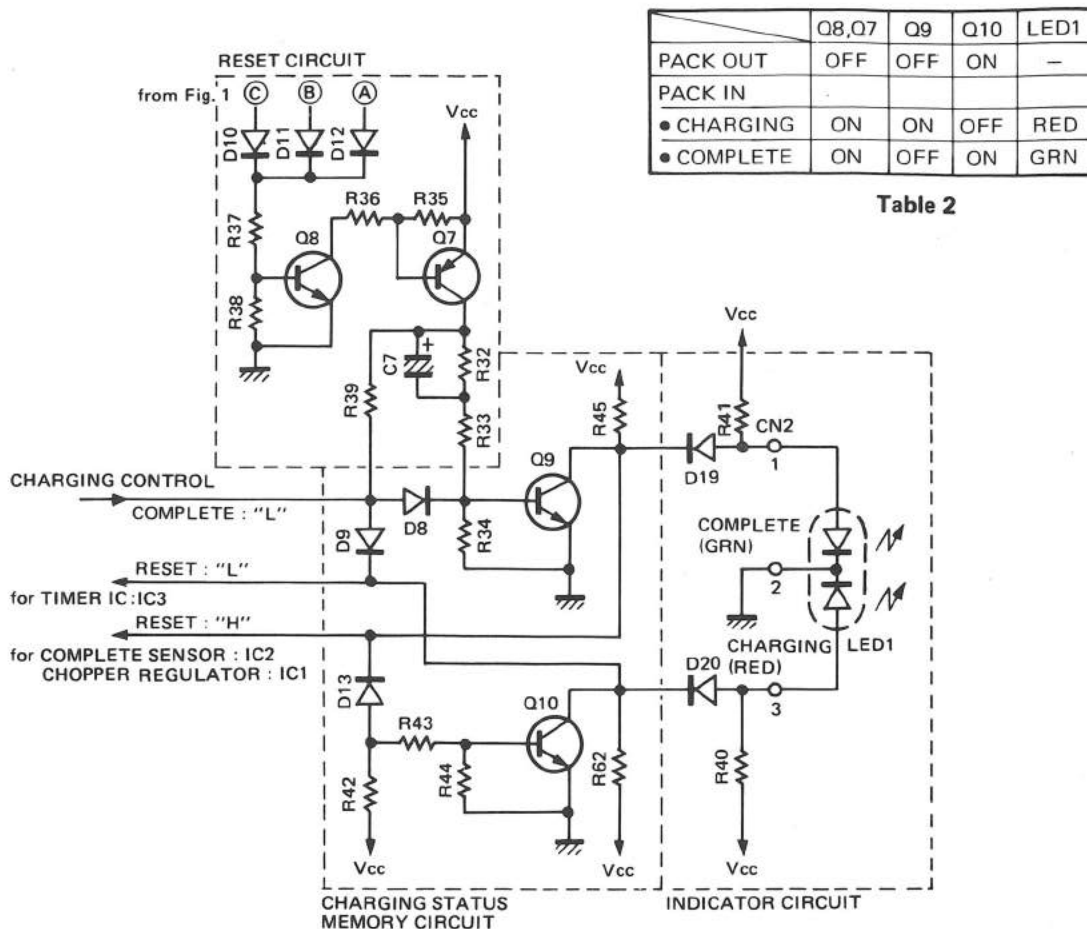
Table 1

Fig. 1 Battery Pack Detect Circuit Block Diagram

## BC-7 (RAPID CHARGER)

### 3) Reset Circuit/Charge Status Memory Circuit/ Display Circuit

The reset circuit initializes the charging status memory circuit.



	Q8,Q7	Q9	Q10	LED1
PACK OUT	OFF	OFF	ON	-
PACK IN				
● CHARGING	ON	ON	OFF	RED
● COMPLETE	ON	OFF	ON	GRN

Table 2

Fig. 2 Reset Circuit/Charge Status Memory Circuit/Display Circuit Block Diagram

The charge status memory circuit is an R-S flip-flop configured from transistors and resistors. The two states of the flip-flop are called COMPLETE and CHARGING. Outputs from the flip-flop drive the LED in the indicator circuit and reset the timer, complete sensor, and chopper regulator. In the COMPLETE state Q9 : 2SC536E is off and Q10 : 2SC536E is on. In the CHARGING state Q9 is on and Q10 is off.

When a battery pack is not inserted, Q8 : 2SC536E and Q7 : 2SC536E turn off. As there is no base voltage to Q9, Q9 also turns off. The base of Q10 receives enough bias from Vcc to turn on, resulting in 0V at the collector. The current flow through R41 to the COMPLETE indicator in LED1 which glows green, because of Q9 if off.

When the battery pack is inserted Q8 and Q7 turn on. As soon as Q7 turns on, charging current flows through R33, R34, and Q9 to C7 and Q9 turns on. The base voltage of Q10, which is connected to Q9 through diode D13, then drops and Q10 turns off. Since Q10 is off, current flows through R40 to the CHARGING indicator in LED1, which glows red to indicate that the battery is charging. When charging of C7 is completed, on-current continues to flow to the base of Q9 through R39 and D8.

When charging is completed the complete sensor (IC2) outputs a Low ("L") signal that ends the flow of current to the base of Q9, turning Q9 off. As a result current flows through R41 to the COMPLETE indicator in LED1, which glows green to indicate that charging is complete.



## BC-7 (RAPID CHARGER)

### 4) Battery Recognition Circuit

The battery recognition circuit uses NAND logic to recognize the battery type from the outputs from the battery pack detect circuit. Outputs from this circuit are sent to the charging current limiting circuit and sensor level switching circuit.

	INPUT			OUTPUT			
BATT.	A	B	C	D	E	F	G
PB-1	L	L	H	H	H	L	L
PB-2	L	H	L	H	L	H	L
PB-3	H	L	L	H	H	L	H
PB-4	H	H	L	L	H	L	H

Table 3

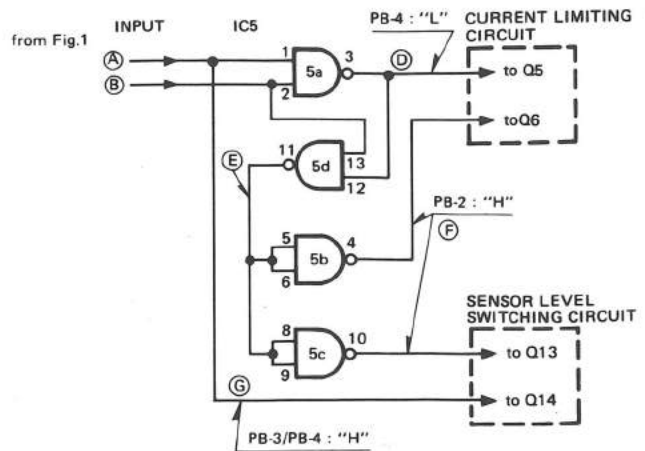


Fig. 3 Battery Recognition Circuit Block Diagram

### 5) Charging Current Limiting Circuit

This circuit receives the output of the battery recognition circuit and limits the charging current according to the type (current capacity) of battery. The charging current ICR is detected as a voltage drop across R1 (0.15Ω), which is provided to pin 3 of the operational amplifier IC4(1/2) : LA6393A. Pin 4 receives a reference voltage (VREF) used as a comparison standard for limiting the charging current. The VREF is changed by ON and OFF of Q5 and Q6 (See Table 4).

Pin 2 of IC4 : LA6393S provides "L" output when  $V_{REF} < V_{CR}$ , stopping the operation of the chopper regulator (IC1 : STK772B) and reducing the charging current. The charging current is limited by the formula :

$$I_{CR \text{ MAX}} (A) = V_{REF} (V) / 0.15(\Omega)$$

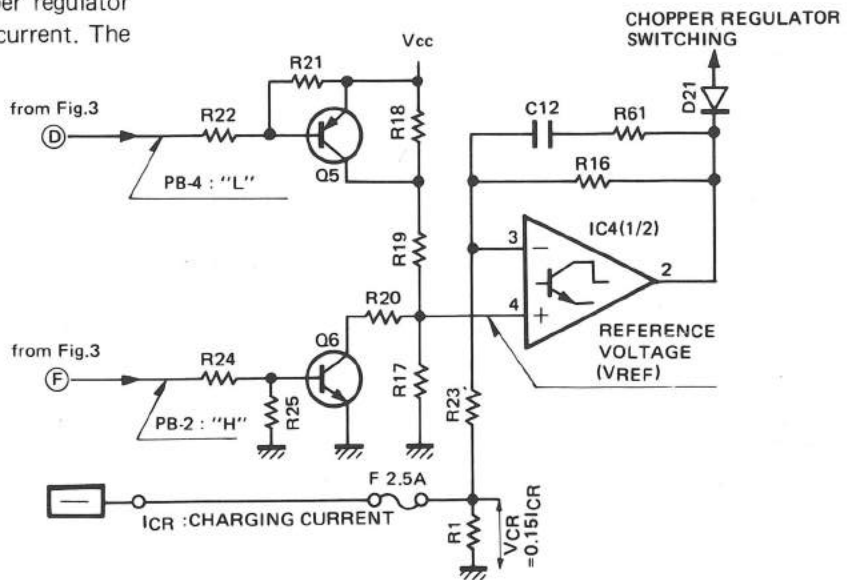


Fig. 4 Charging Current Limiting Circuit Block Diagram

BATT.	Q5	Q6	VREF	ICR MAX
PB-1	OFF	OFF	0.28V	1.8A
PB-2	OFF	ON	0.2V	1.3A
PB-3	OFF	OFF	0.28V	1.8A
PB-4	ON	OFF	0.36V	2.4A

Table 4

## BC-7 (RAPID CHARGER)

### 7) Charging Status Detect Circuit

This circuit detects the completion of charging and outputs a signal to stop charging. When no battery pack is inserted or charging is completed, a High ("H") Reset signal is applied to D15. When a battery is inserted the Reset signal applied to D15 is cleared. When the Reset signal is cleared, pin 4 of IC2 : KCH-1003 holds the reset state due to the charge in C8 for the duration of the R46-C8 time constant, then goes "L" to clear the reset state. Pins 8 and 9 of IC2 receive divided portions of the battery voltage. These inputs are tracked as the charging is performed in the long-term memory capacitor "MD". As the Ni-Cd battery charges, the battery voltage reaches a peak, then declines. (See **Figure 6.**) The MD stores the peak voltage, which is compared with the divided voltages at pins 8 and 9. When the difference  $\Delta V$  is the same, a "L" signal is output from pin 11 to indicate that charging is complete. The signal indicating completion of charging is applied to the charging status memory circuit.

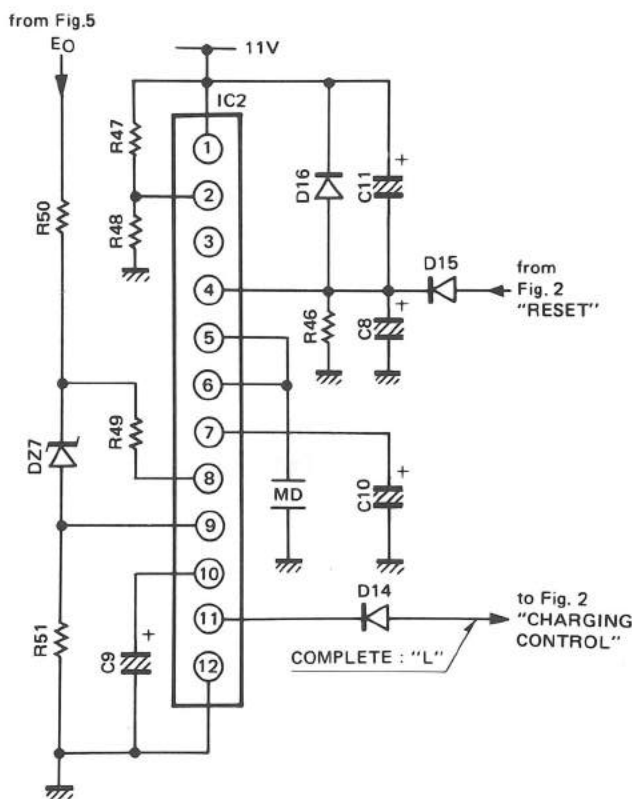


Fig. 7 Charging Status Detect Circuit Block Diagram

### 8) Timer Circuit

Battery defects may result in charging continuing indefinitely without completion, so this timer outputs a signal that stops charging approximately 1.7 hours after charging begins. When charging begins and the Reset signal is cleared at pin 3, IC3 : AN6780 begins counting. At the first count of 16384 pin 6 goes from "H" to "L". The output from pin 6 is connected to the Stop input (pin 2), so the output of IC3 is held in the "L" state until IC3 receives another Reset signal (for example, when the battery is removed).

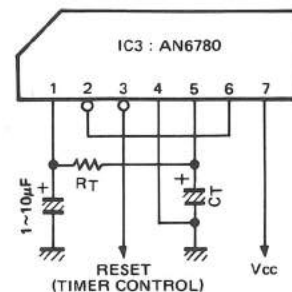


Fig. 8 Timer Circuit Block Diagram

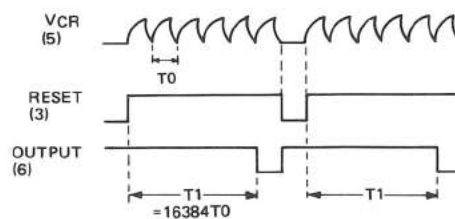


Fig. 9  
 TIMER TIME  $T1 (s) \approx 11RT(K\Omega) \cdot CT(\mu F)$   
 TIMER TIME  $T1 (s) \approx 11 \times 56(K\Omega) \cdot 10(\mu F) = 6160(s)$

### 9) Voltage Comparator Circuit

This circuit monitors the output (EO) of the sensor level switching circuit and indirectly detects abnormal conditions in the battery pack connected to the charging terminal. When the EO voltage falls to 5.2V or lower, the charging control line goes "L" to halt charging.

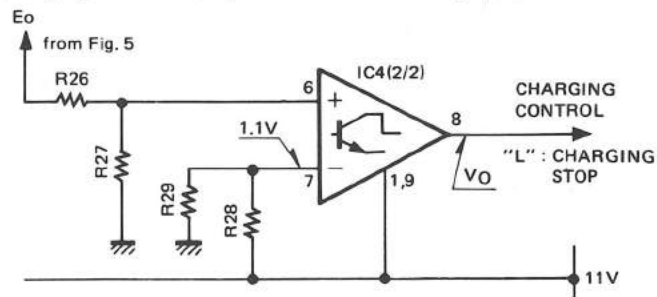


Fig. 10 Voltage Comparator Circuit Block Diagram

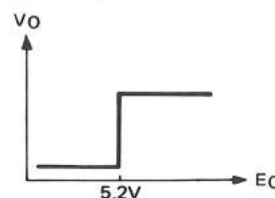


Fig. 11

## BC-7 (RAPID CHARGER)

### 6) Sensor Level Switching Circuit

This circuit receives the output of the battery recognition circuit and aligns the voltages supplied to the charging status detect circuit according to the battery type (voltage) so that they are nearly equal at completion of charging.

	Q11,Q13	Q12,Q14	EO (V)
PB-1	OFF	OFF	EI-7.6
PB-2	ON	OFF	EI-3.4
PB-3	OFF	ON	EI-2
PB-4	OFF	ON	EI-2

Table 5

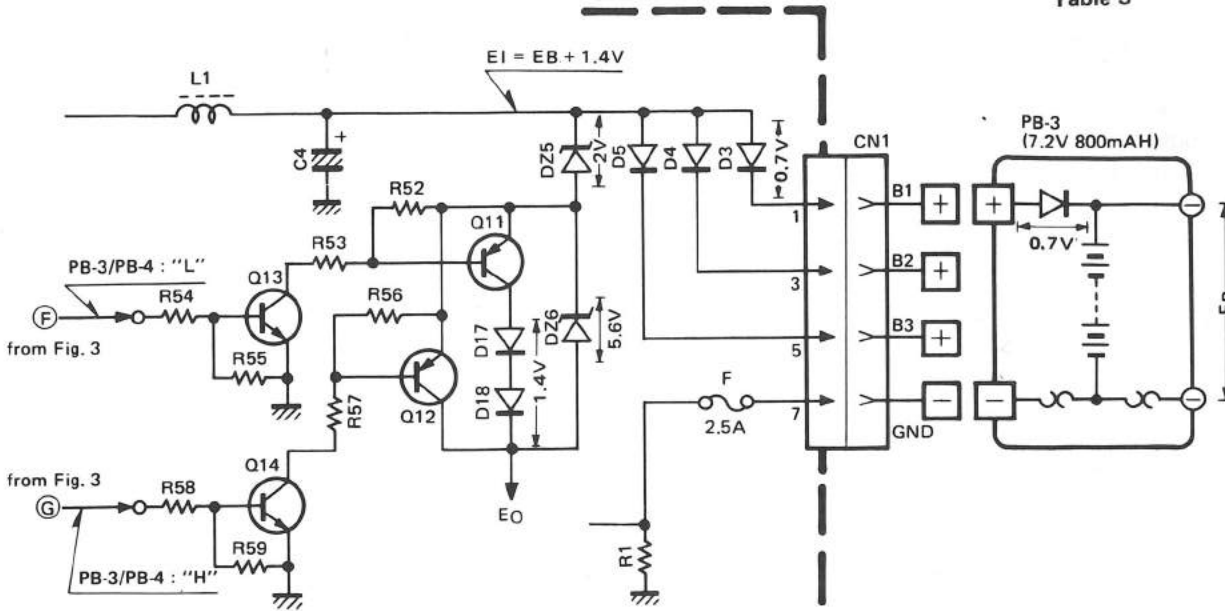


Fig. 5 Sensor Level Switching Circuit Block Diagram

The pin voltages while the Ni-Cd battery is charging are approximately 1.2 times the voltages at the completion of charging. (See **Figure 6**.)

The battery terminal voltage EB is as follows:

- Approximately 14.4V for the PB-1 (12V, 800mAh)
- Approximately 10.0V for the PB-2 (8.4V, 500mAh)
- Approximately 8.6V for the PB-3 (7.2V, 800mAh)
- Approximately 8.6V for the PB-4 (7.2V, 1600mAh)

The charging line voltage EI is the EB voltage plus a 1.4V voltage drop added by a diode.

$$EI = EB + 1.4V \dots \dots (1)$$

The EI voltage is output with a level shift as the voltage EO to the charging status detect circuit via Zener diode DZ6 and diodes D17 and D18. The amount of the shift is controlled by switching Q11 : 2SA608E and Q12 : 2SA608E on and off. (See **Table 5**.) If Eq. (1) is substituted into EO in **Table 5**, the results are:

- PB-1 : EO = EB-6.2V
- PB-2 : EO = EB-2V
- PB-3 or PB-4 : EO = EB-0.6V

At the completion of charging the value is approximately 8V.

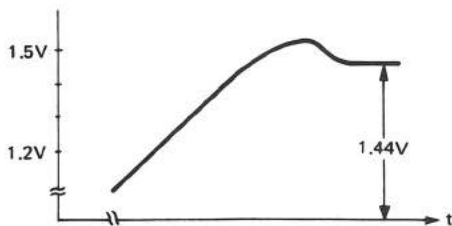


Fig. 6 The pin voltages while the Ni-CD Battery is charging

## BC-7 (RAPID CHARGER)

× New Parts

Parts without Parts No. are not supplied.

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

Telle ohne Parts No. werden nicht geliefert.

### BC-7 PARTS LIST

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
<b>BC-7</b>						
1	1A	*	A02-0776-08	CASE		
2	1A,1B	*	A02-0778-05	BATTERY POCKET		
3	1B		B46-0411-00	WARRANTY CARD	K	
4	1B	*	B50-8134-08	INSTRUCTION MANUAL		
5	1B	*	E23-0488-05	TERMINAL		
Δ 6	2A	*	E30-2038-08	AC CORD	K,M,M2, P	
Δ 6	2A	*	E30-2072-08	AC CORD	W	
Δ 6	2A	*	E30-2073-08	AC CORD	T	
8	2B	*	H01-8062-08	ITEM CARTON CASE		
9	2B		H10-2584-02	POLYSTYRENE FOAMED FIXTURE (L)		
10	2B		H10-2585-02	POLYSTYRENE FOAMED FIXTURE (R)		
11	3A		J02-0439-05	FOOT		
12	3A	*	J39-0424-05	SPACER		
Δ T1	2A	*	L01-8081-08	POWER TRANSFORMER (AC120V)	K,M2,P	
Δ T1	2A	*	L01-8112-08	POWER TRANSFORMER (AC220V)	M,W	
Δ T1	2A	*	L01-8122-08	POWER TRANSFORMER (AC240V)	T	
A	3A		N30-3006-41	MACHINE SCREW (M3 X 6)		
B	2A,1B		N34-4006-46	MACHINE SCREW (M4 X 6 TR)		
C	2A,1B		N35-4006-45	MACHINE SCREW (M4 X 6 BI) BLK		
D	2A		N87-3008-46	TAPTITE SCREW (φ3 X 8 BR)		
E	1A		N89-3008-45	TAPTITE SCREW (φ3 X 8 BI) BLK		
SW1	3A		S36-1407-05	POWER SW		
7	3B	*	W02-0389-05	CHARGE CONTROL UNIT		
			Resolder R64 (430Ω) and solder it to R41 printed on the PC board.			
<b>CHARGE CONTROL UNIT (W02-0389-05)</b>						
C1			CE04EW1V222M	ELECTRO 2200μF 35WV		
C2			CE04EW1C470M	ELECTRO 47μF 16WV		
C3			CE04EW1H010M	ELECTRO 1μF 50WV		
C4			CE04EW1E471M	ELECTRO 470μF 25WV		
C5,6			CE04EW1C100M	ELECTRO 10μF 16WV		
C7			CE04EW1A101M	ELECTRO 100μF 10WV		
C8			CE04EW1C100M	ELECTRO 10μF 16WV		
C9,10			CE04EW0J101M	ELECTRO 100μF 6.3WV		
C11			CE04EW1C330M	ELECTRO 33μF 16WV		
C12			CK45B1H102K	CERAMIC 0.001μF 50WV		
C14			CE04EW1H010M	ELECTRO 1μF 50WV		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada

A: Saudi Arabia T: England U: PX(Far East, Hawaii)

UE: AAFES(Europe) X: Australia M: Other Areas

Δ indicates safety critical components.

## BC-7 (RAPID CHARGER)

× New Parts

Parts without Parts No. are not supplied.

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

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
MD			C91-1038-08	ELECTRO		
△ F1			F05-2525-05	FUSE (2.5A)	W	
△ F1		*	F06-2522-05	FUSE (2.5A)	M,M2,T	
△ F1		*	F06-2523-05	FUSE (2.5A)	K,P	
—			J13-0039-05	FUSE HOLDER	W	
L1		*	L33-0694-08	CHOKE COIL (470μH)		
R1		*	R92-0683-08	FL-PROOF 0.15Ω 4W		
D1-5			DSA26B	DIODE		
D6-21			DS442	DIODE		
DZ1		*	GZA11Y	ZENER DIODE (11V)		
DZ2-4		*	GZA10Z	ZENER DIODE (10V)		
DZ5		*	GZA2.0X	ZENER DIODE (2V)		
DZ6		*	GZA5.6X	ZENER DIODE (5.6V)		
DZ7		*	GZA7.5Y	ZENER DIODE (7.5V)		
DZ8			GZA3.0X	ZENER DIODE (3V)		
IC1		*	STK772B	IC (CHOPPER REGULATOR)		
IC2		*	KCH-1003	IC (VOLTAGE SENSOR)		
IC3			AN6780	IC (TIMER)		
IC4			LA6393S	IC (DUAL OP IC)		
IC5			LC4011B	IC (QUADRUPLE NAND GATE)		
Q1		*	2SD600F,KF	TRANSISTOR		
Q2-5		*	2SA608E,F	TRANSISTOR		
Q6		*	2SC536E,F	TRANSISTOR		
Q7		*	2SA608E,F	TRANSISTOR		
Q8-10			2SC536E,F	TRANSISTOR		
Q11,12			2SA608E,F	TRANSISTOR		
Q13,14			2SC536E,F	TRANSISTOR		
LED1	2A		SLP-540D	LED (RED/GRN)		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada

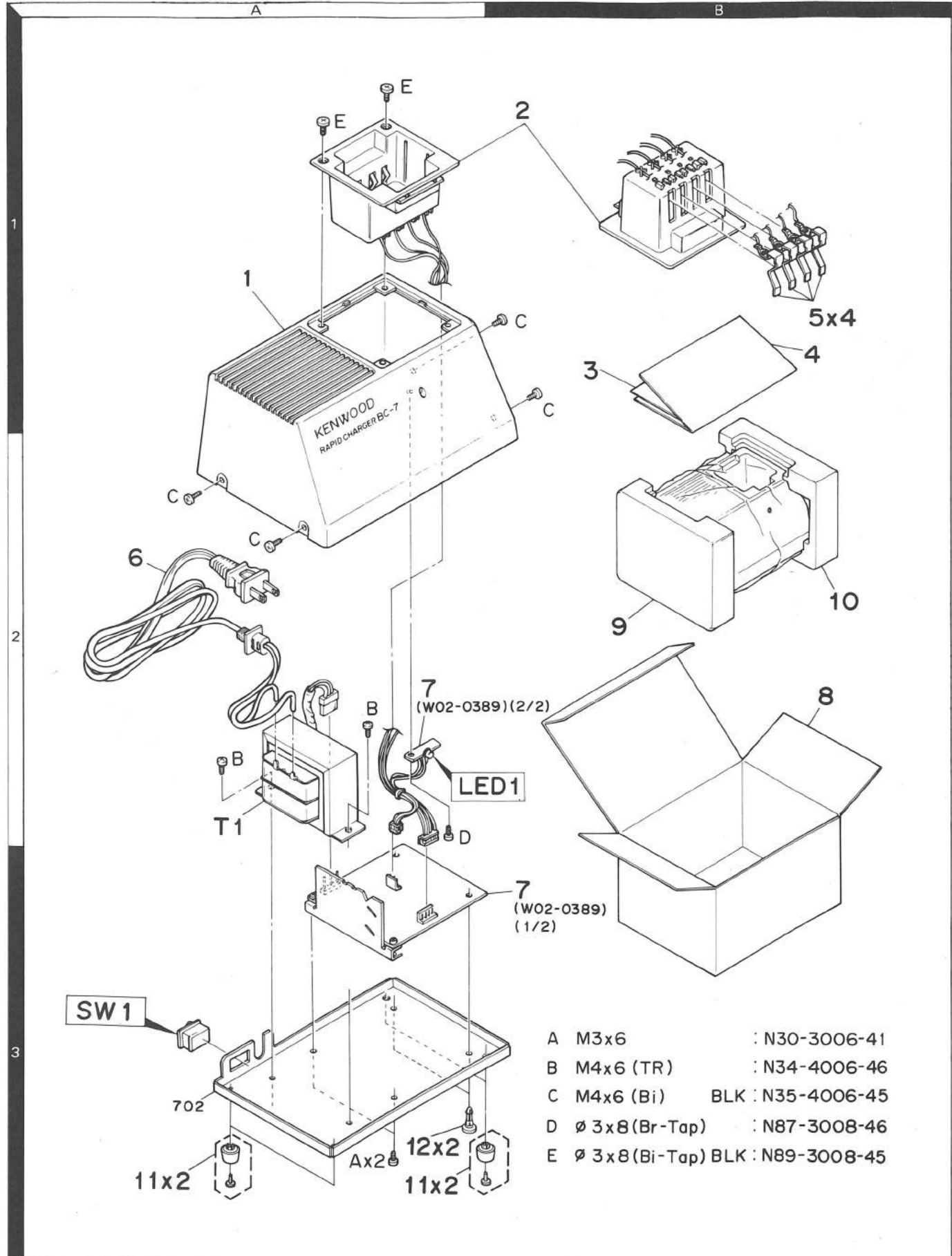
A: Saudi Arabia T: England U: PX (Far East, Hawaii)

UE: AAFES (Europe) X: Australia M: Other Areas

△ indicates safety critical components.

## BC-7 (RAPID CHARGER)

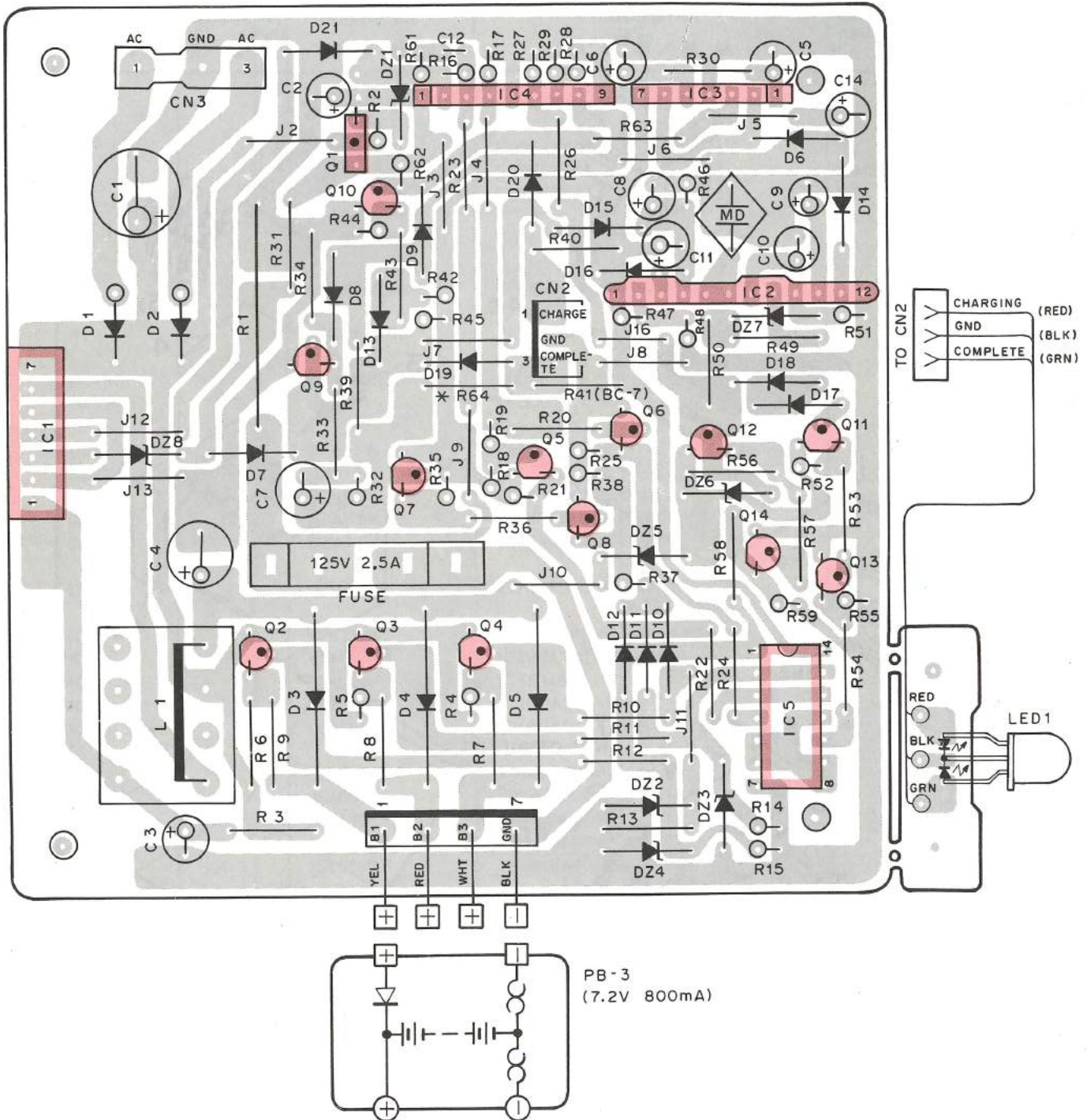
### BC-7 EXPLODED VIEW/PACKING



Parts with the exploded numbers larger than 700 are not supplied.

## BC-7 (RAPID CHARGER)

### BC-7 PC BOARD VIEW



Q1 : 2SD600F,KF Q2-5,7,11,12 : 2SA608E,F Q6,8-10,13,14 : 2SC536E,F  
 IC1 : STK772B IC2 : KCH-1003 IC3 : AN6780 IC4 : LA6393S IC5 : LC4011B  
 D1-5 : DSA26B D6-21 : DS442  
 DZ1 : GZA11Y DZ2-4 : GZA10Z D5 : GZA2.0X DZ6 : GZA5.6X DZ7 : GZA7.5Y DZ8 : GZA3.0X

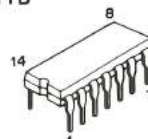
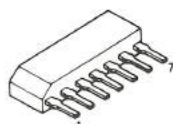
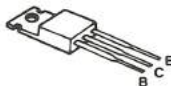
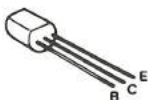
2SA608E  
2SA608F

2SC536E 2SD600F  
2SC536F 2SD600KF

AN6780

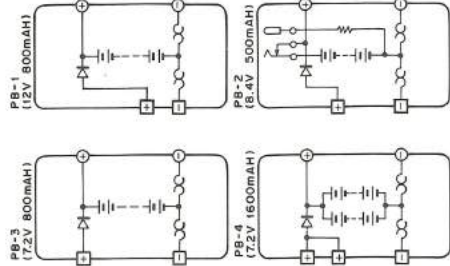
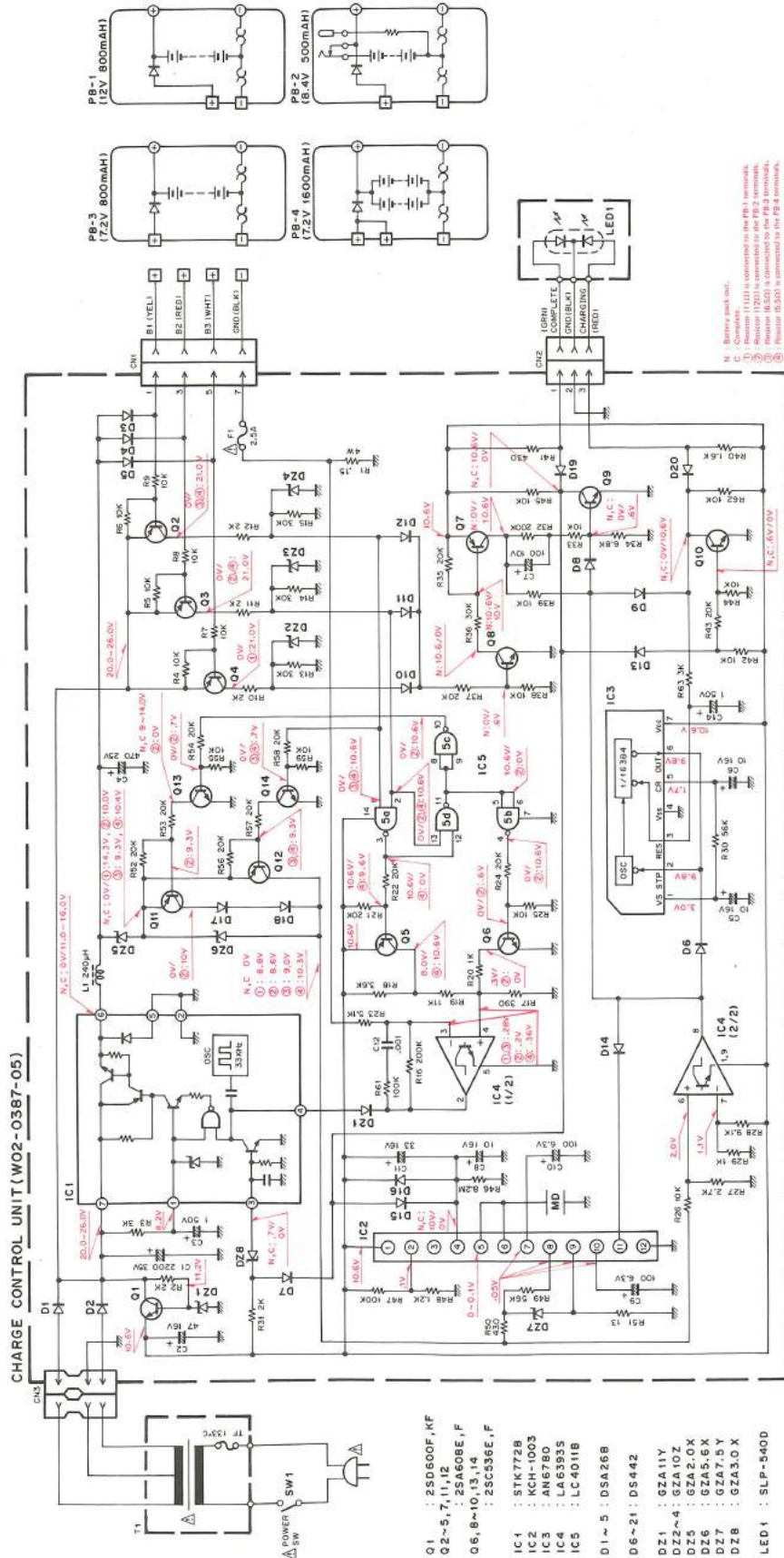
LC4011B

LA6393S



## BC-7 (RAPID CHARGER)

### BC-7 CIRCUIT DIAGRAM





## BC-8 (COMPACT CHARGER)

BC-8 EXTERNAL VIEW

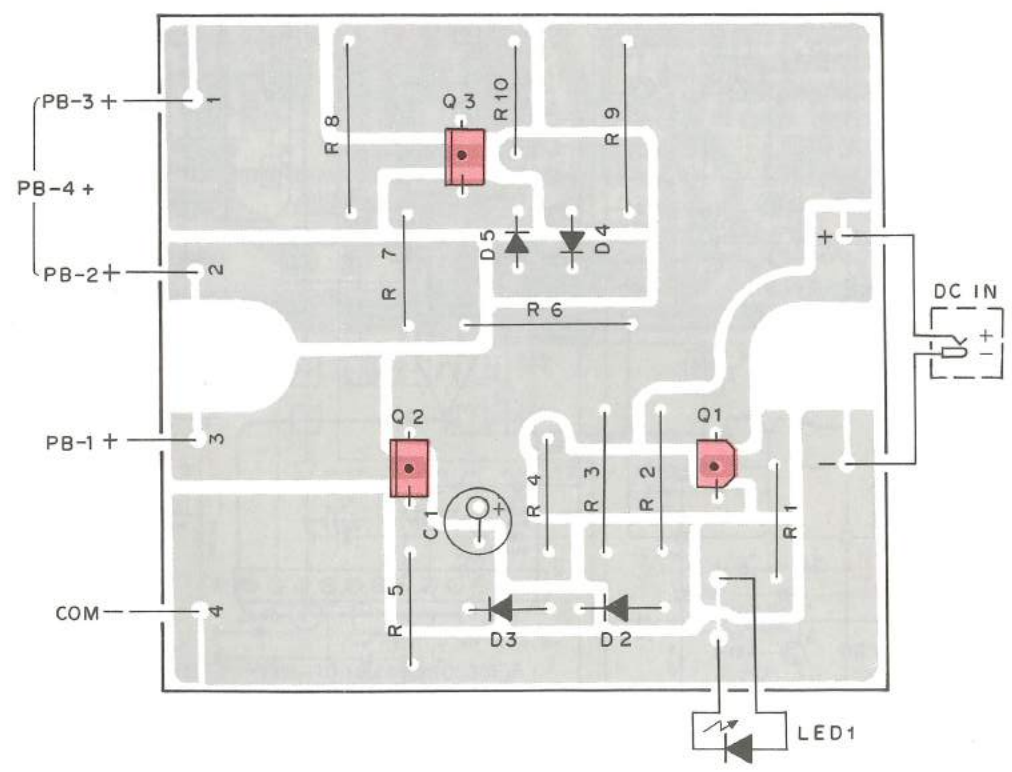


BC-8 PARTS LIST

N : New parts

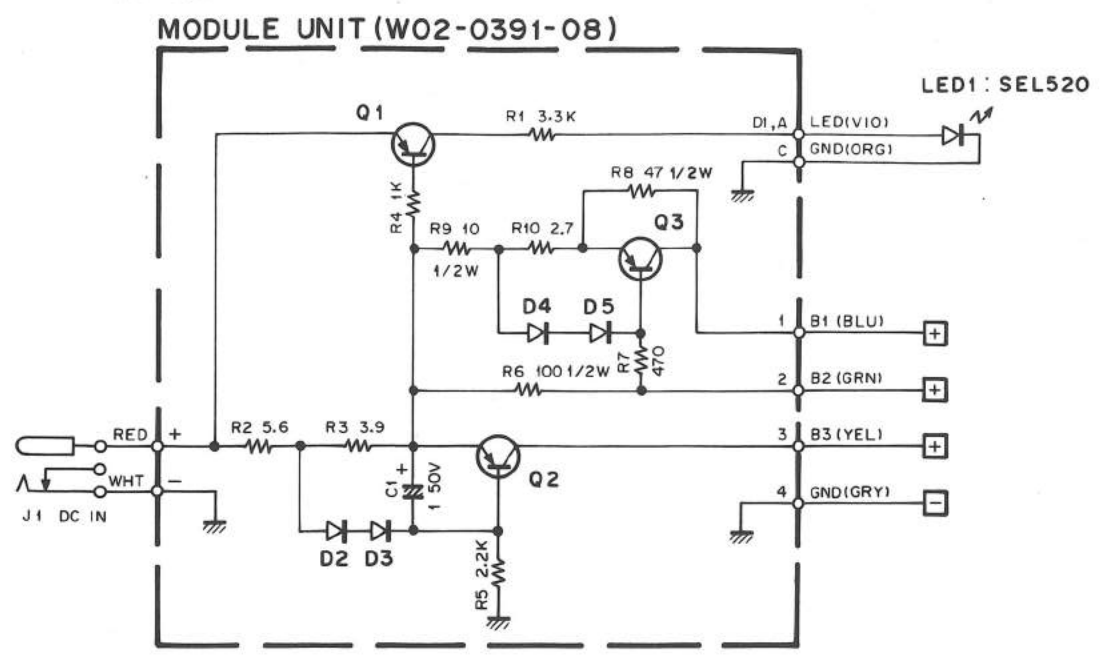
Parts No.	Re- marks	Description	Ref.No.
A02-0778-05		Battery pocket	
B50-8137-18	N	Instruction manual K,M1,M2, W,F	
B50-8138-18	N	Instruction manual T	
E03-0168-05	N	DC jack	
J19-1423-05	N	LED holder	
W02-0391-08	N	Module unit	
△ W09-0376-08	N	AC adaptor AC 120V K	
△ W09-0377-08	N	AC adaptor AC 220V M1	
△ W09-0378-08	N	AC adaptor AC 120V M2	
△ W09-0379-08	N	AC adaptor AC 220V W	
△ W09-0380-08	N	AC adaptor AC 120V P	
△ W09-0381-08	N	AC adaptor AC 240V T	
2SA1115(E)		TR	Q1
2SA1241Y		TR	Q2,3
1SS133		Diode	D2~5
SEL520	N	LED	LED1

BC-8 PC BOARD VIEW

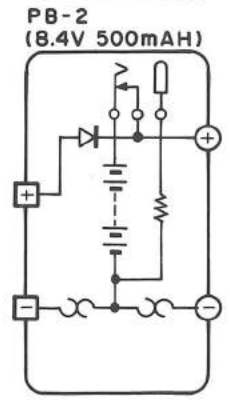
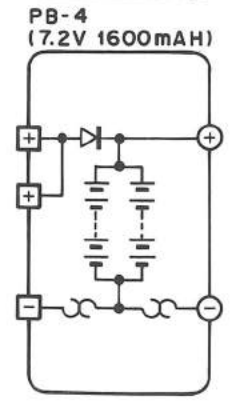
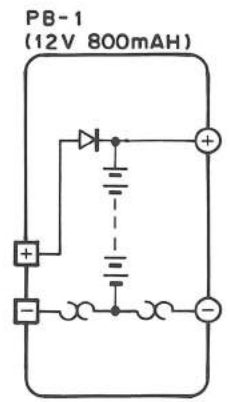
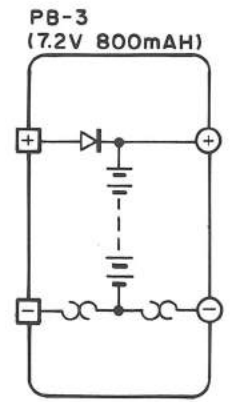
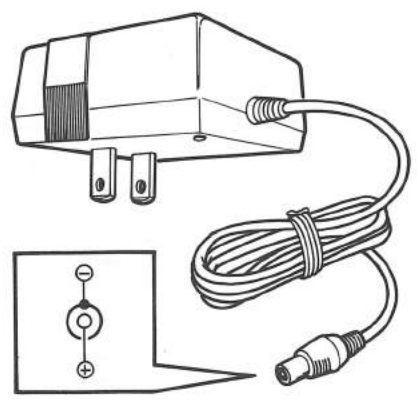


## BC-8 (COMPACT CHARGER)

### BC-8 CIRCUIT DIAGRAM

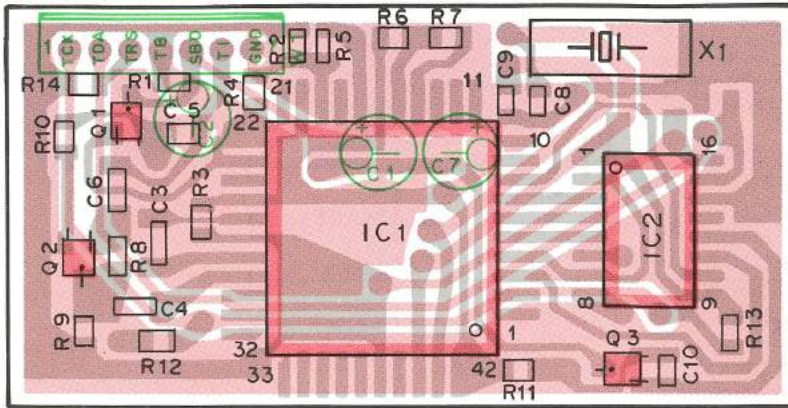


- Q1 : 2SA1115(E)
- Q2, 3 : 2SA1241Y
- D2~5 : 1SS133

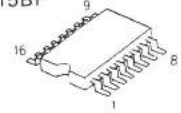


## TSU-4 (TONE SQUELCH UNIT)

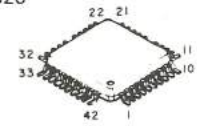
TSU-4 PC BOARD VIEW



TC4015BF



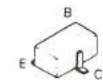
MN6520



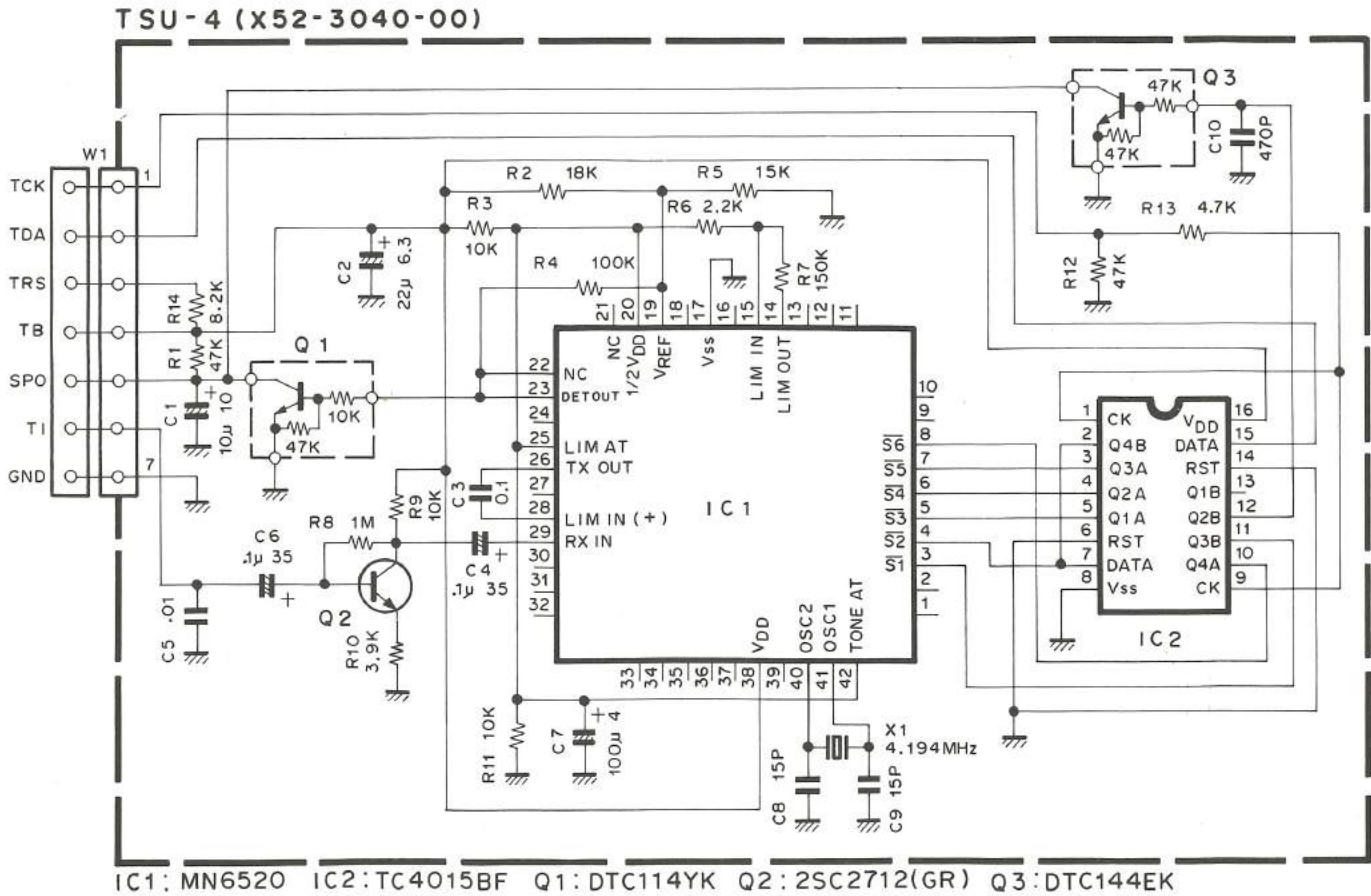
DTC114YK  
DTC144EK



2SC2712



TSU-4 CIRCUIT DIAGRAM



## TSU-4 (TONE SQUELCH UNIT)

× New Parts

Parts without Parts No. are not supplied.

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

Teile ohne Parts No. werden nicht geliefert.

### TSU-4 PARTS LIST

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
<b>TSU-4</b>						
-		*	B50-8130-00	INSTRUCTION MANUAL		
-			G13-0820-14	CUSHION (ACSY)		
-			J90-0402-04	GUIDE		
<b>TONE UNIT (X52-3040-00)</b>						
C1			CE04CW1A100M	ELECTRO 10UF 10WV		
C2			CE04CWOJ220M	ELECTRO 22UF 6.3WV		
C3			CK73EB1E104K	CHIP C 0.10UF K		
C4			C92-0001-05	TANTAL 0.1UF 35WV		
C5			CK73FB1H103K	CHIP C 0.010UF K		
C6			C92-0001-05	TANTAL 0.1UF 35WV		
C7			CE04CWOJ101M	ELECTRO 100UF 4.0WV		
C8	.9		CC73FCH1H150J	CHIP C 15PF J		
C10			CK73FB1H471K	CHIP C 470PF K		
W1			E31-3223-15	CONNECTING WIRE		
X1			L77-1313-05	CRYSTAL RESONATOR(4.194304MHZ)		
R1			RK73FB2A473J	CHIP R 47K J 1/10W		
R2			RK73FB2A183J	CHIP R 18K J 1/10W		
R3			RK73FB2A103J	CHIP R 10K J 1/10W		
R4			RK73FB2A104J	CHIP R 100K J 1/10W		
R5			RK73FB2A153J	CHIP R 15K J 1/10W		
R6			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R7			RK73FB2A154J	CHIP R 150K J 1/10W		
R8			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R9			RK73FB2A103J	CHIP R 10K J 1/10W		
R10			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R11			RK73FB2A103J	CHIP R 10K J 1/10W		
R12			RK73FB2A473J	CHIP R 47K J 1/10W		
R13			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R14			RK73FB2A822J	CHIP R 8.2K J 1/10W		
IC1			MN6520	IC(CTCSS SYSTEM)		
IC2			TC4015BF	IC(DUAL 4-STAGE SHIFT RESISTOR)		
Q1			DTC114YK	DIGITAL TRANSISTOR		
Q2			2SC2712(GR)	TRANSISTOR		
Q3			DTC144EK	DIGITAL TRANSISTOR		

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

 indicates safety critical components.

## SPECIFICATIONS

### General

Frequency range	220.000MHz – 224.995MHz
Signal type	F3 (F3E)
Power supply voltage	DC 6.3V – 15V (Battery terminal) DC 7.2V – 16V (DC IN jack)
Power consumption	At reception standby ; Approx. 55mA At battery power save ; Approx. 11mA At transmission (5W) ; Less than 1.7A At transmission (0.5W) ; Less than 0.7A
Antenna impedance	50Ω
EXT. MIC impedance	2kΩ
Operating temperature	–20°C – +50°C
Dimensions	67 (69.5) W x 173 (180.7) H x 37 (40) D mm The numbers in the parenthesis include projections parts.
Weight	540g (including antenna and Ni-Cd batteries)

### Transmitter section

Output power	Hi ; 5W, Low ; 0.5W
Modulation system	Reactance modulation
Max. frequency deviation	±5kHz
Unwanted reflection	Less than –60dB
Frequency tolerance	Less than $\pm 20 \times 10^{-6}$ (–10°C ~ +50°C)

### Receiver section

Reception system	Double superheterodyne
Intermediate frequency	1st IF ; 16.9MHz 2nd IF ; 455kHz
Sensitivity	12dB SINAD ; 0.2μV
Squelch sensitivity	Less than 0.1μV
Selectivity	–6dB at more than 12kHz, –40dB at more than 24kHz
AF output	More than 350mW (8Ω load, distortion 10%)

Design and specifications subject to change without notice.

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