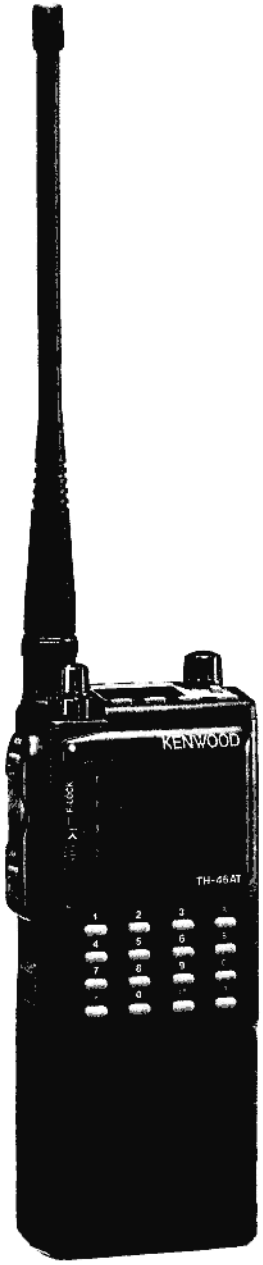
70cm FM HANDHELD TRANSCEIVER

TH-46A/AT/E

SERVICE MANUAL

KENWOOD

B51-8042-00 (A) 959



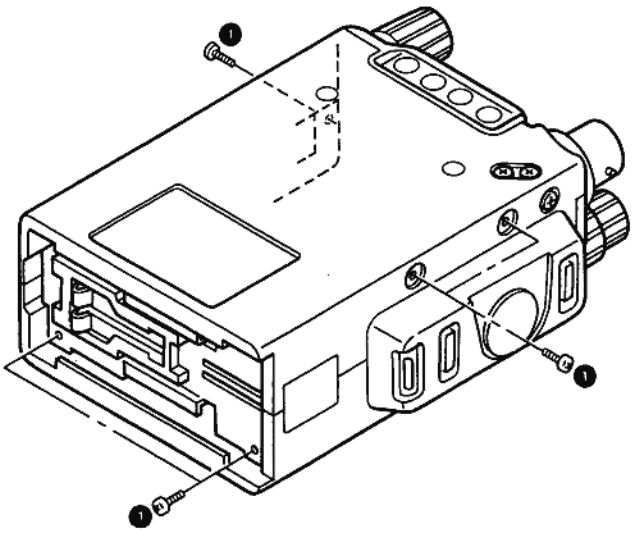
CONTENTS

TH-46A/AT/E

DISASSEMBLY FOR REPAIR

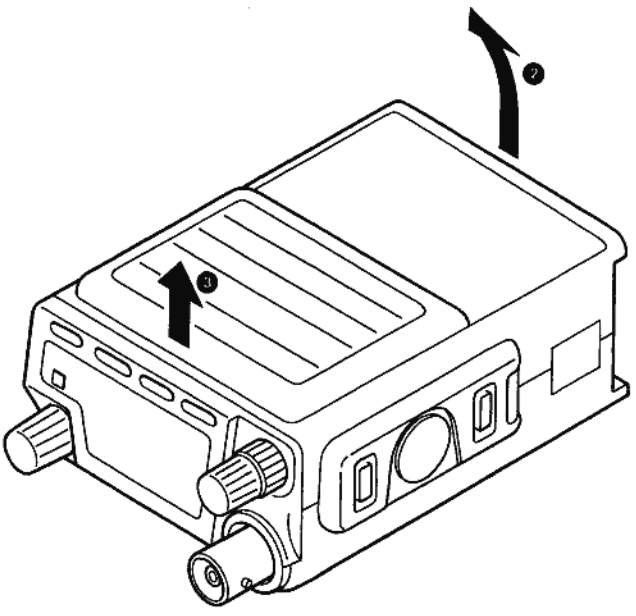
1. Removing the Case

1) Remove the two screws from the front-case side of the bottom plate, as well as the three screws from both sides of the front and rear cases ①.



2) Raise the bottom plate ② and detach the panel side ③ of the front case by pulling it up.

Note: Use care when pulling ③ so the FPC cable in the front case is not cut.

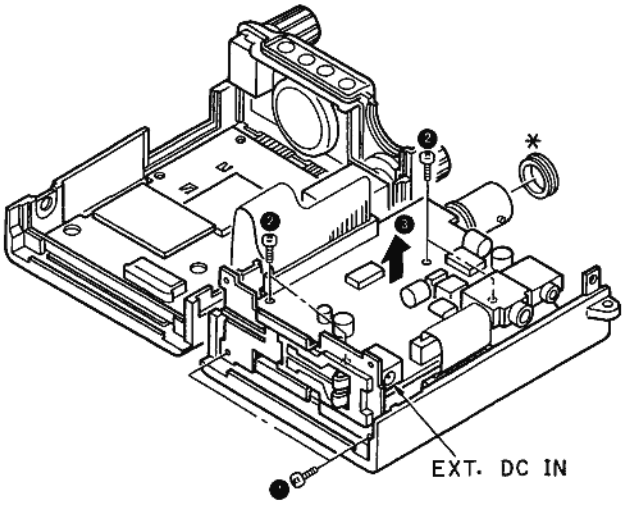


DISASSEMBLY FOR REPAIR

2. Removing the TX/RX Unit (A/2)

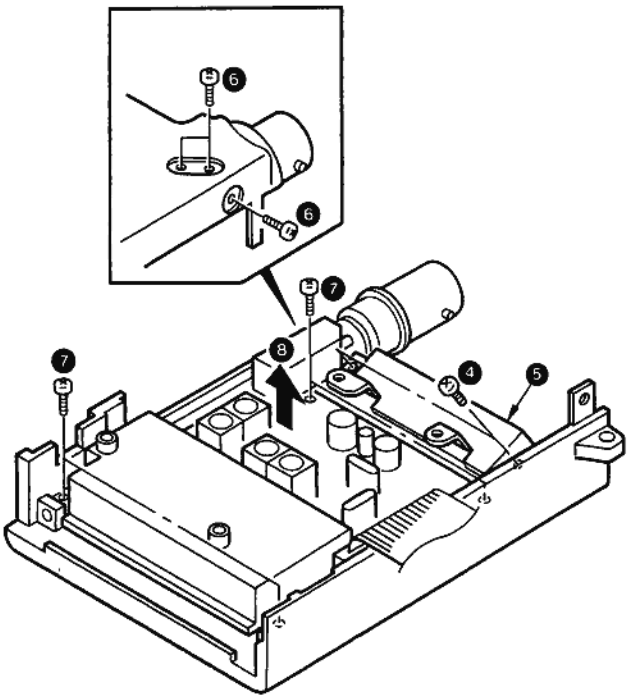
1) For the TH-26A/AT/E, remove the two screws clamping the bottom plate ①.
2) Remove the four screws ② clamping the TX/RX unit (A/2).
3) Raise the TX/RX unit (A/2) until it is off the rear case ③.
4) Remove the rubber ring of the ANT connector (*)

Note: The control unit and TX/RX unit (A/2, B/2) can be checked by connecting an external power supply to EXT DC IN without unplugging the FPC cable.



3. Removing the TX/RX Unit (B/2)

1) Remove the two screws ④ clamping the power module and remove the shield case ⑤. Now the power module can be replaced by unsoldering its lead wire.
2) Locate the three screws ⑥ clamping the ANT connector. Remove them from the rear case.
3) Remove the four screws ⑦ clamping the TX/RX unit (B/2) and pull out B/2.

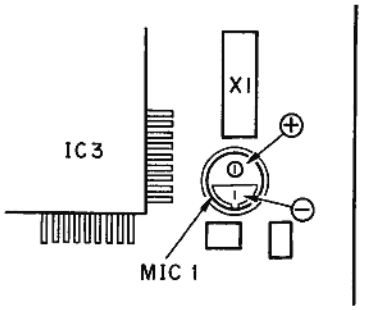


DISASSEMBLY FOR REPAIR

4. Removing the Control Block

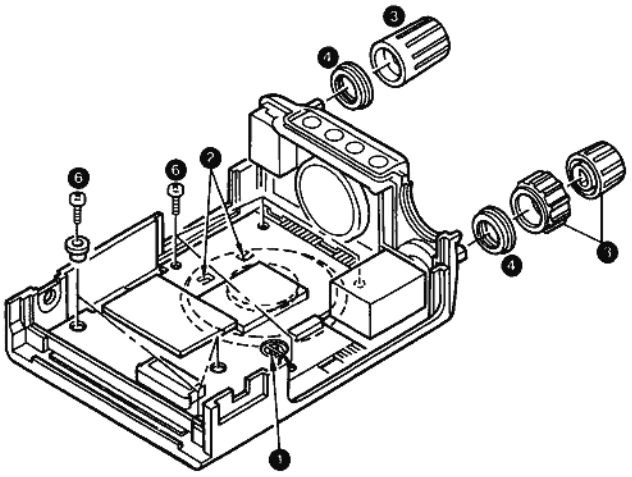
1) Removing the condenser microphone (MIC 1) only
   - The condenser microphone can be changed without removing the control unit.
   - Unsolder the FPC. Raise the FPC and pull out the microphone unit alone in the upward direction.

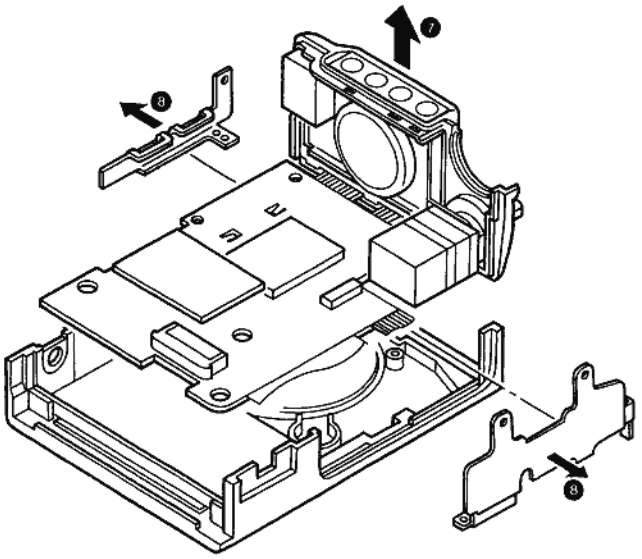
Note: Polarity of condenser microphone
The condenser microphone should be installed to the polarity shown.



2) Removing the control unit

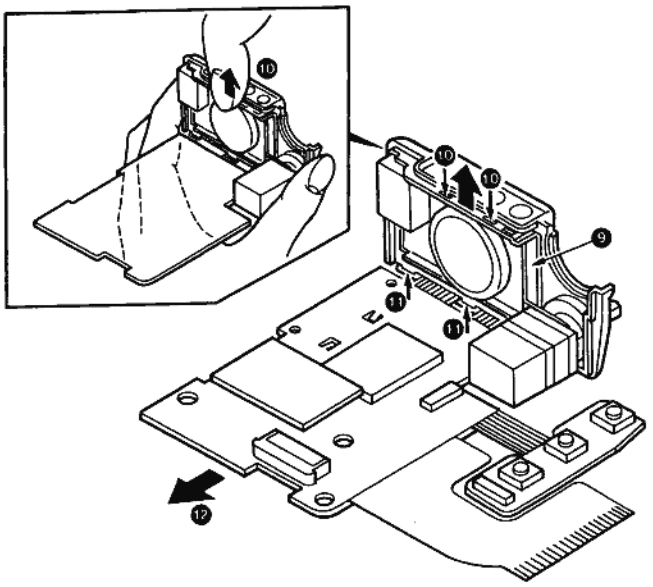
Note: Before removing the control unit (W02-16xx-xx), the two FPCs ② must be unsoldered off the speaker (SP1).
   - When disassembling the LCD block as well, remove the knobs ③ and nuts ④ of the squelch and encoder.
   - Remove the seven screws ⑥ clamping the control unit.
   - Hold the front panel and pull up the control unit off the front case ⑦.
   - Remove the control unit clamps ⑧.



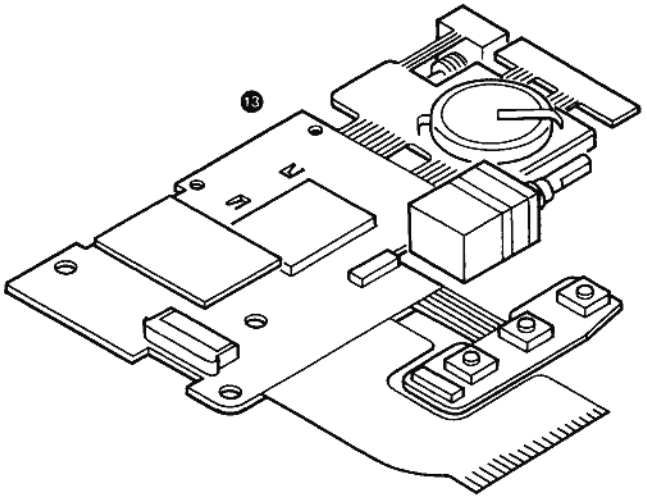


DISASSEMBLY FOR REPAIR

- When detaching the LCD block from the front panel, pull the edge of the front panel in the arrowed direction (➡) until the claw of the clamp ⑨ comes off the groove ⑩.
- Release the claws on the bottom of the front panel from the grooves ⑪.
- Free the clamp ⑨ and slowly slide the control unit ⑫ toward you until it comes off the front panel. (The FPC cable should not be exerted with undue force.)



- The figure below shows how the control unit looks after it is disassembled.



TH-46A/AT/E

CIRCUIT DESCRIPTION

1. Frequency Configuration

The frequency configuration is shown in Table 1 and Figure 1.

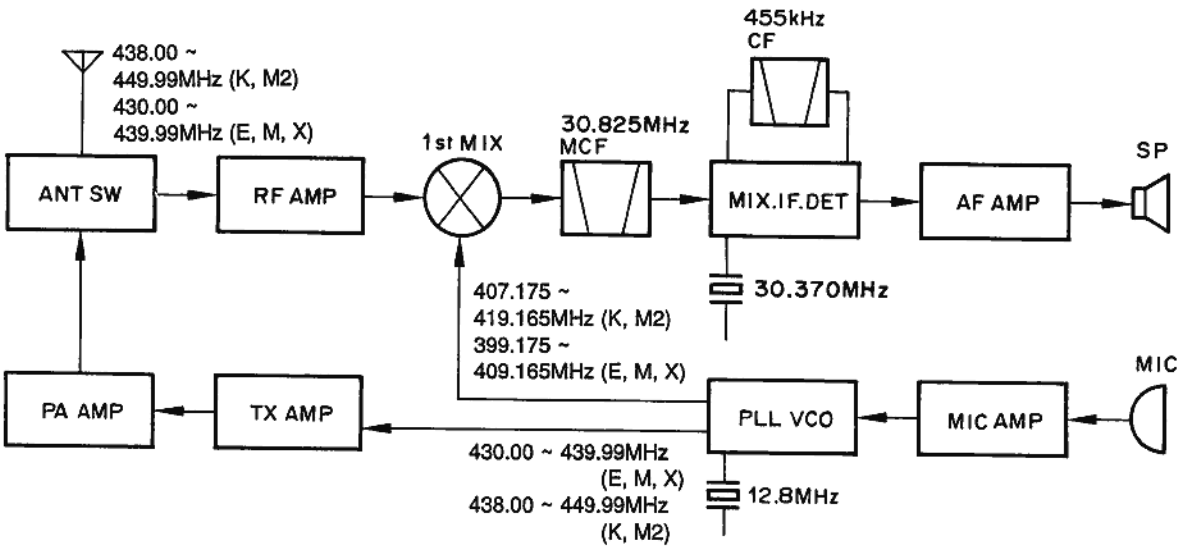


Fig. 1 Frequency configuration

Receiving System	Double conversion techniques	
	1st IF frequency	30.825 MHz
	2nd IF frequency	455 kHz
Transmitting System	Direct frequency division	
Modulation	Reactance	

Table 1 Configuration

2. Receiver System

1) RF amplifier

Incoming signals from the antenna pass through a low-pass filter and the transmit/receive switching circuit and enter the RF amplifier section. The signals are amplified by two RF amplifiers, Q23 and Q22.

Undesirable signals are removed by a bandpass filter composed of helical resonators L25 and L23

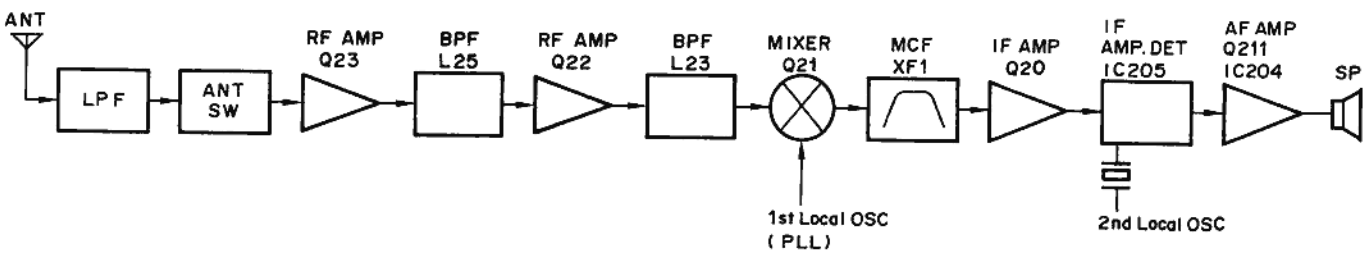


Fig. 2 RX section block diagram

CIRCUIT DESCRIPTION

2) First mixer

The signal is then mixed with the first local oscillator signal, from the PLL circuit, by Q21 to produce the first intermediate frequency (IF) signal.

The first IF signal passes through a two stage monolithic crystal filter circuit (MCF) to further remove undesired signals.

Item	Rating
Nominal center frequency (f_0)	30.825kHz
Pass band width	±7.5kHz or more at 3dB
Attenuation band width	±32kHz or less at 40dB
Ripple	1.5dB or less
Insertion loss	3dB or less
Guaranteed attenuation	60dB or more within ±1MHz (Spurious: 40dB or more)
Terminal impedance	1.4kΩ/±10%/1pF±10%

Table 2 MCF (L71-0263-05) (TX-RX unit XFI)

3) IF amplifier

The first IF signal is amplified by Q20, and then enters IC205 (FM processing IC). Here the signal is mixed with the second local oscillator signal by IC205 to produce the second IF signal. The second IF signal passes through a ceramic filter to remove undesired signals, and is then reapplied to IC205 further amplification and demodulation.

Item	Rating
Nominal center frequency (f_0)	455kHz ±1.5kHz
6dB band width	±7.5kHz or more
40dB band width	±15kHz ore less
Guaranteed attenuation	1.5dB or less
Ripple	27dB or more
Insertion loss	6dB or less
I/O matching impedance	1.5kΩ

Table 3 Ceramic filter (L72-0362-05) (TX-RX unit CF201)

CIRCUIT DESCRIPTION

4) AF amplifier

The frequency characteristics of the detected FM audio signal are corrected by the de-emphasis circuit composed of R252 and C261 and active high-pass filter circuit Q211. The audio signal passes through the AF volume control and is amplified to the desired level by the power amplifier IC204.

5) Squelch and mute circuit

The output from the squelch circuit composed of IC205 and Q212 is applied to pin 12 of the microprocessor via the SC pin. The microprocessor controls the MUTE1 and MUTE2 lines according to the SC input logic and other functional conditions, in order to controls the audio.

The microprocessor also controls MUTE1, MUTE2 and the audio when the bell function, CTCSS, or DTSS operates.

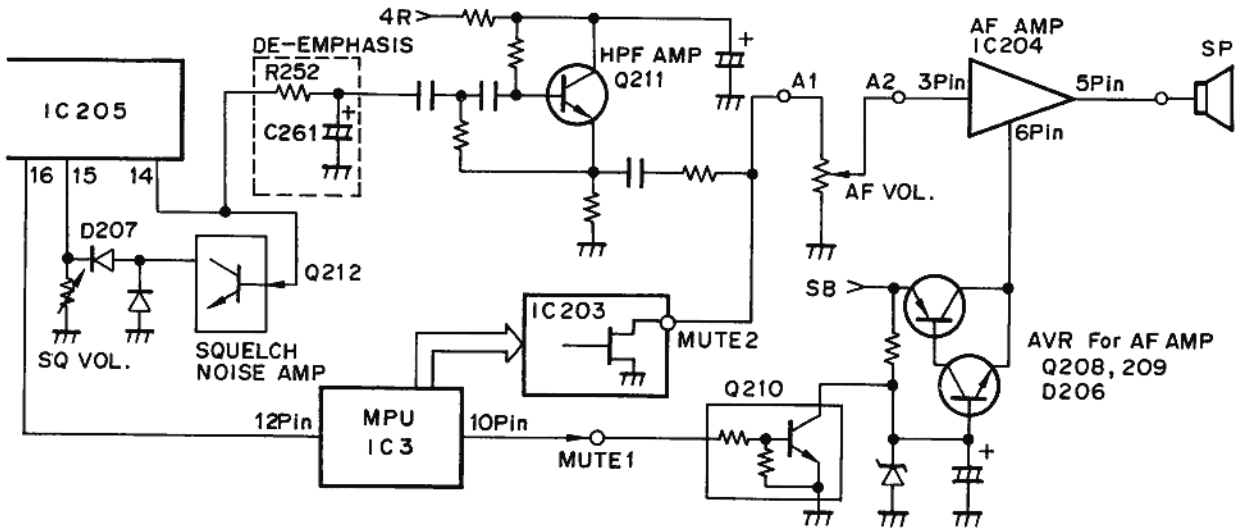


Fig. 3 AMP, Squelch and Mute Circuit

Condition			MU1	MU2
TX			H	H
RX	Normal operation	When squelch ON	H	H
		When squelch OFF	L	L
	Bell operation	When waiting	H	H
		At reception (bell operation)	L	H

Mute operation when "H"

Table 4 Mute Operating Conditions

6) S-meter circuit

The signal for the S-meter is obtained from pin 12 of IC205 as a DC control voltage corresponding to the input signal level and is applied to pin 14 of the microprocessor. This DC voltage is A/D converted and is used to control the S-meter display of the LCD.

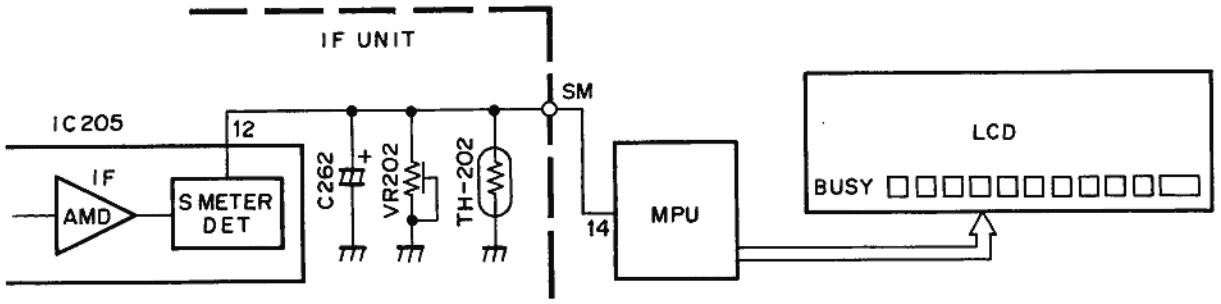


Fig. 4 S-Meter Circuit

3. Transmitter System

1) Microphone amplifier circuit

The signal from the microphone passes through a 6dB/oct pre-emphasis circuit composed of C216 and R209, and is then amplified and limited by IC201 (1/2). Distorted signals components outside the audio band are removed by the splatter filter composed of IC201 (2/2).

2) Modulation circuit

The output from the microphone amplifier passes through the microphone gain control VR201 and is applied to the VCO varactor diode (D1).

3) Drive and final circuit

The desired transmit signal is generated directly by the VCO, and is amplified by buffer amplifiers Q2 and Q6 to approximately 0 dBm. The signal is further amplified to approximately 14 dBm by Q9 and Q10. The amplified signal passes through pin diode D6 for transmit output adjustment and enters the power module IC1. The power module is a three stage amplifier and amplifies the power to about 5 W.

4) Transmit/receive switching circuit

The transmitter output passes through the transmit/receive switching circuit and low-pass filter, and is fed to the antenna. The transmit/receive switching circuit is composed of D7 and D9, which are both on in the transmit mode and off in the receive mode.

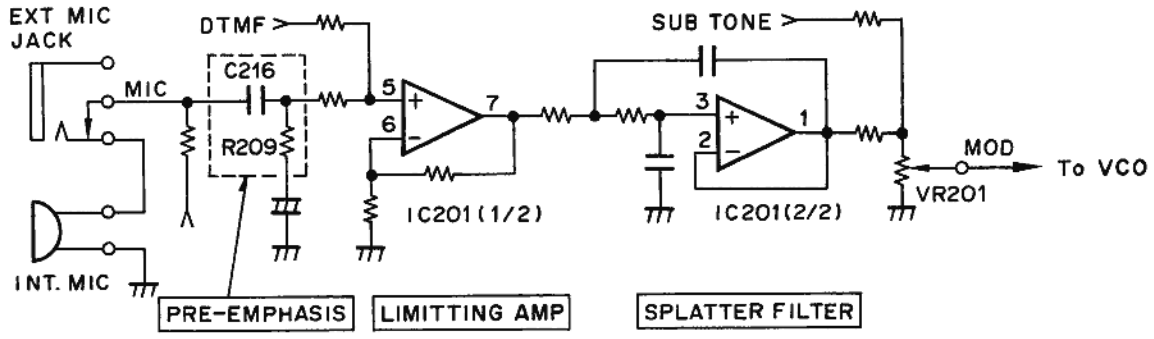


Fig. 5 MIC AMP Circuit

CIRCUIT DESCRIPTION

5) APC circuit and transmitter output switching circuit

The automatic power control (APC) circuit supplies stable transmission power. It works by detecting the collector current of the final unit of the power module.

The comparator (IC206) compares the transmit output adjustment reference voltage generated by zener diode (D208) and voltage dividers VR203 and VR204 with the detection voltage at R268 and R269 proportional to the collector voltage of the final module.

An APC voltage proportional to the difference between the reference voltage and the detection voltage appears at the output pin (pin 6) of IC206. The APC voltage controls the attenuation of diode D6 on the input side of the power module and keeps the transmitter output stable.

When the transmitter output changeover switch is set to LO, Q214 turns on, changes the reference voltage, and keeps the transmit output at about 0.5 W.

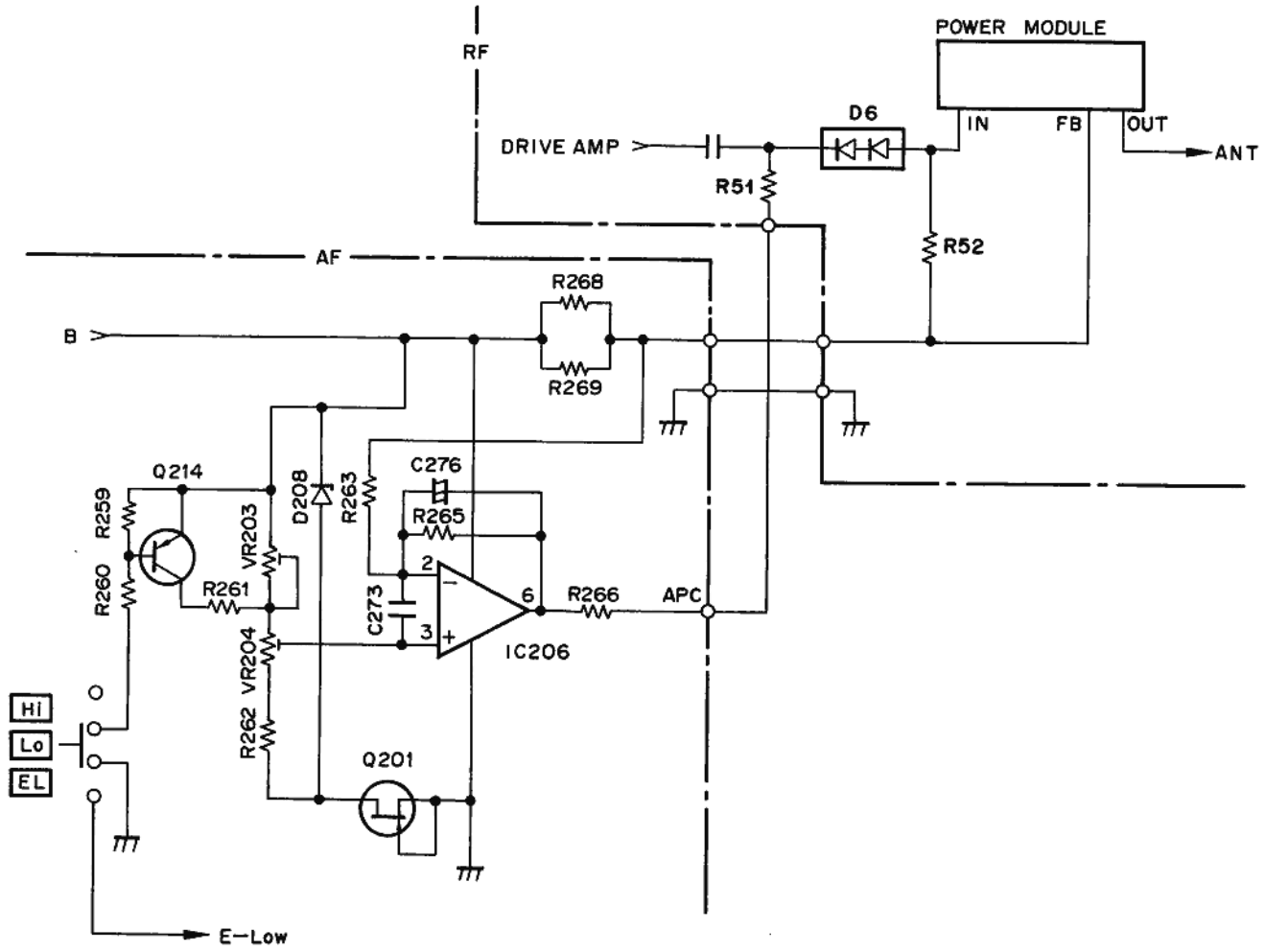


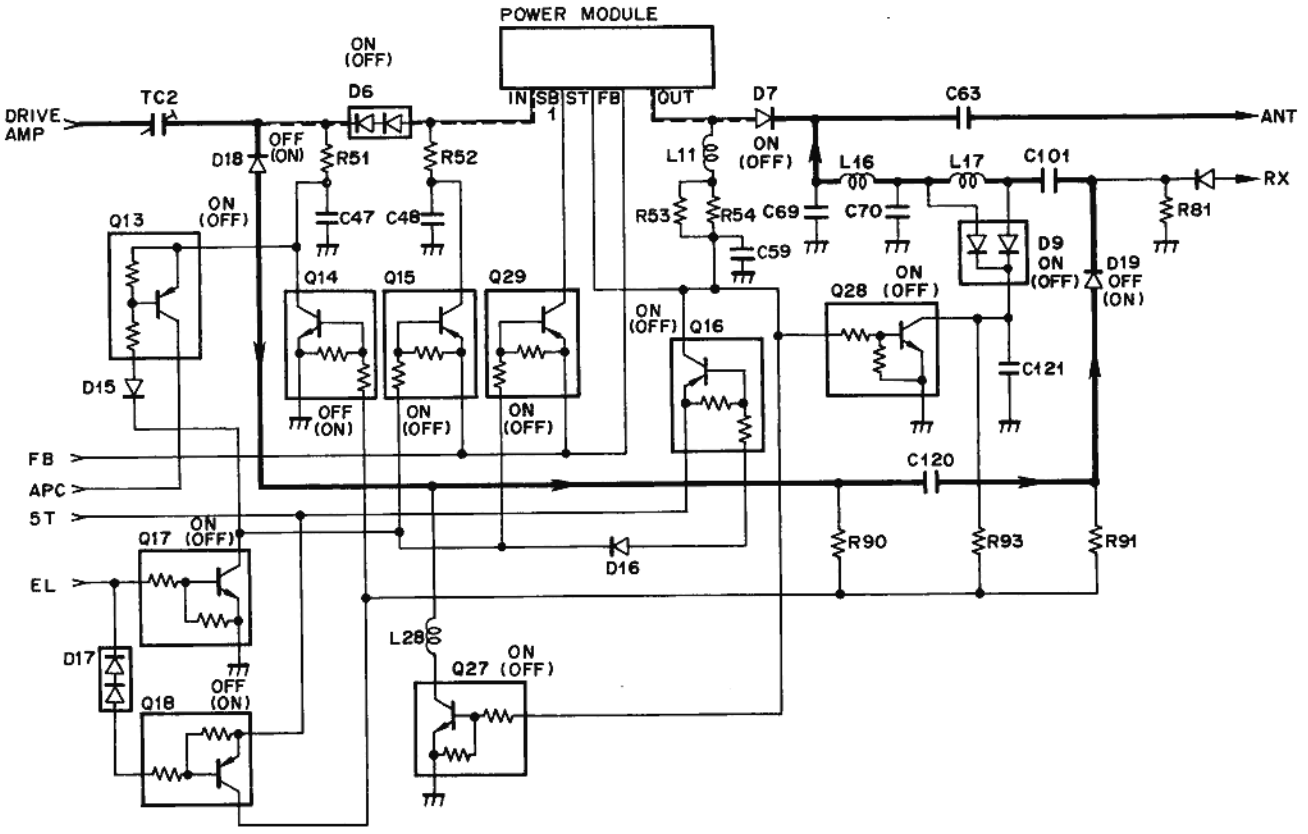
Fig. 6 APC Circuit and Transmitter output Switching Circuit

CIRCUIT DESCRIPTION

6) Economic low-power circuit

The economic low-power circuit supplies the drive output directly to the antenna. The current consumption is lowered since the power module bias is switched off. When the transmitter power changeover switch is set to EL, and EL pin is grounded and the transmitter circuit performs the following operations:

① Q17 and Q16 turn off, and the 5T line of the power module switches to 0 V. At the same time, D7 turns off, and the power module output circuit opens.
② Q29 turns off, and current does not flow to SB1 of the power module.
③ Q13 and Q15 turn off, Q14 turns on, and D6 turns off, so the drive output is no longer fed to the power module.
④ Q18 turns on, Q27 turns off, then D18 and D19 turn on. Q28 turns off, then D9 turns off, so the drive output is fed to the antenna through D18, C120, D19, C101, L17, and L16.



——— Path at time of HI or LO power
——— Path at time of EL (economic low power)
[ ]: At time of E-Low

Fig.7 Economic Low-Power Circuit

CIRCUIT DESCRIPTION

4. PLL Circuit

1) PLL

The minimun frequency step of the PLL circuit is 5 kHz.

The reference oscillator frequency of X1 (12.8MHz) is divided by IC1 to produce the 5kHz or 6.25kHz reference frequency. The comparison frequency is obtained by amplifying the VCO output with Q4 and then dividing it with the pulse-swallow PLL IC IC1. The PLL circuit, have 5kHz, 10kHz, 12.5kHz, 15kHz, 20kHz, and 25 kHz steps, and is configured by comparing the phases of the reference frequency generated by dividing X1 with the comparison frequency.

2) VCO

The desired frequency is directly generated by clap oscillator FET Q1. The frequency of oscillation is changed by applying the VCO control voltage to varactor diodes D3 and D4. The T/R pin is " H " in receive mode, and the oscillation frequency range is switched by turning Q31 and D2 on.

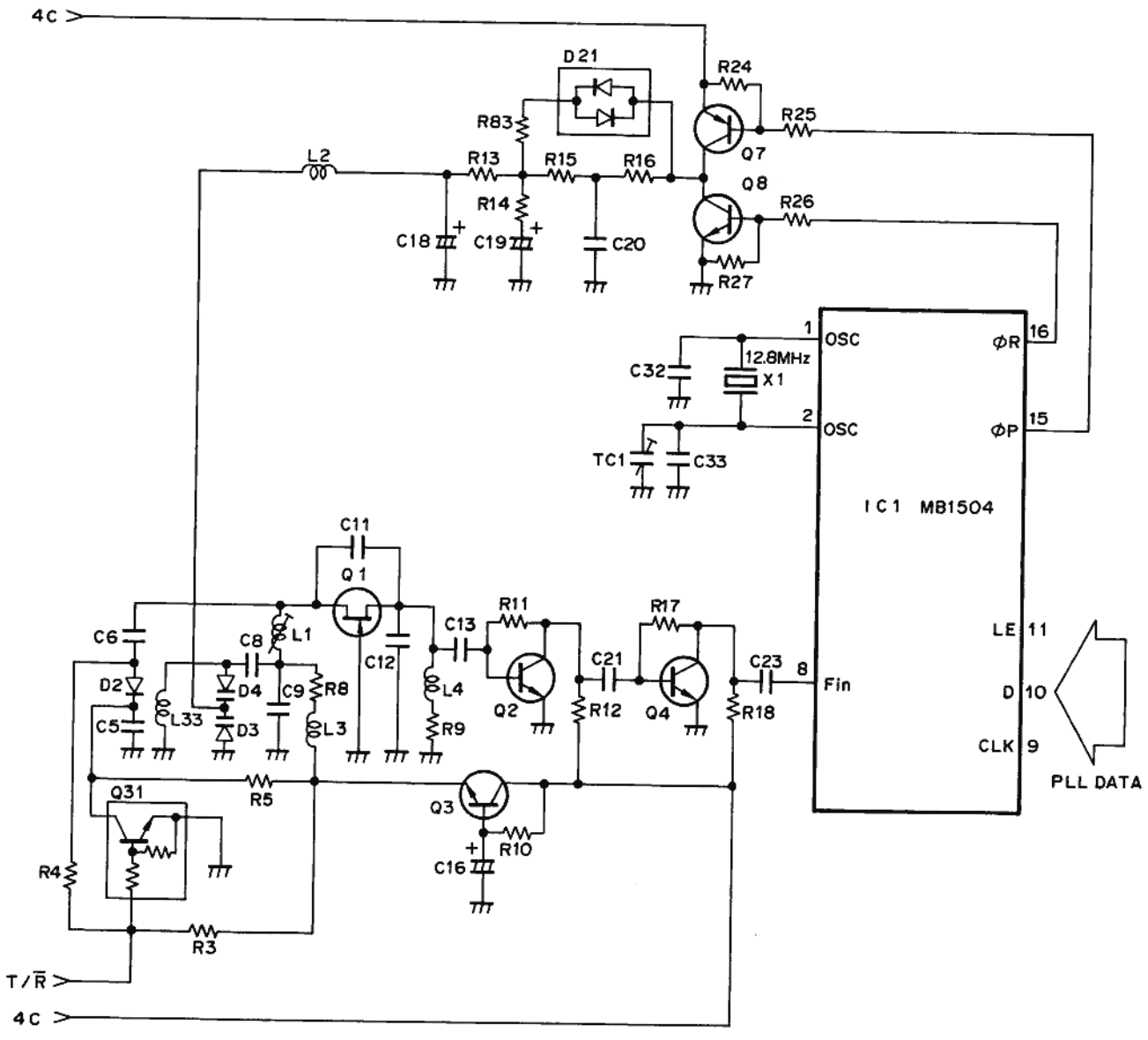


Fig .8 PLL and VCO Circuit

CIRCUIT DESCRIPTION

3) Unlock detection circuit

When the PLL is unlocked, the signal applied to the LD pin (pin 7) of IC1 is shaped by D5, R28, C150 and IC2, causing the UL pin go " H ".

The timing of transmit/receive switching is controlled by the microprocessor, which monitors the voltage on the UL pin.

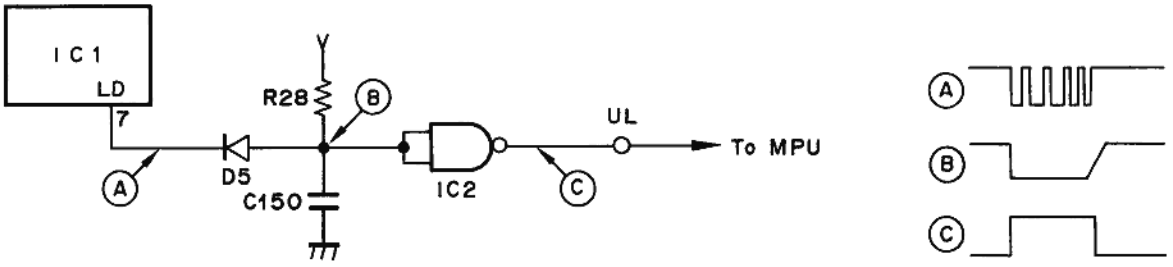


Fig.9 Unlook Detection Circuit

5. Digital Control Circuits

1) Key, rotary encoder circuit

The signal is applied directly to the microprocessor as shown in Figure 10.

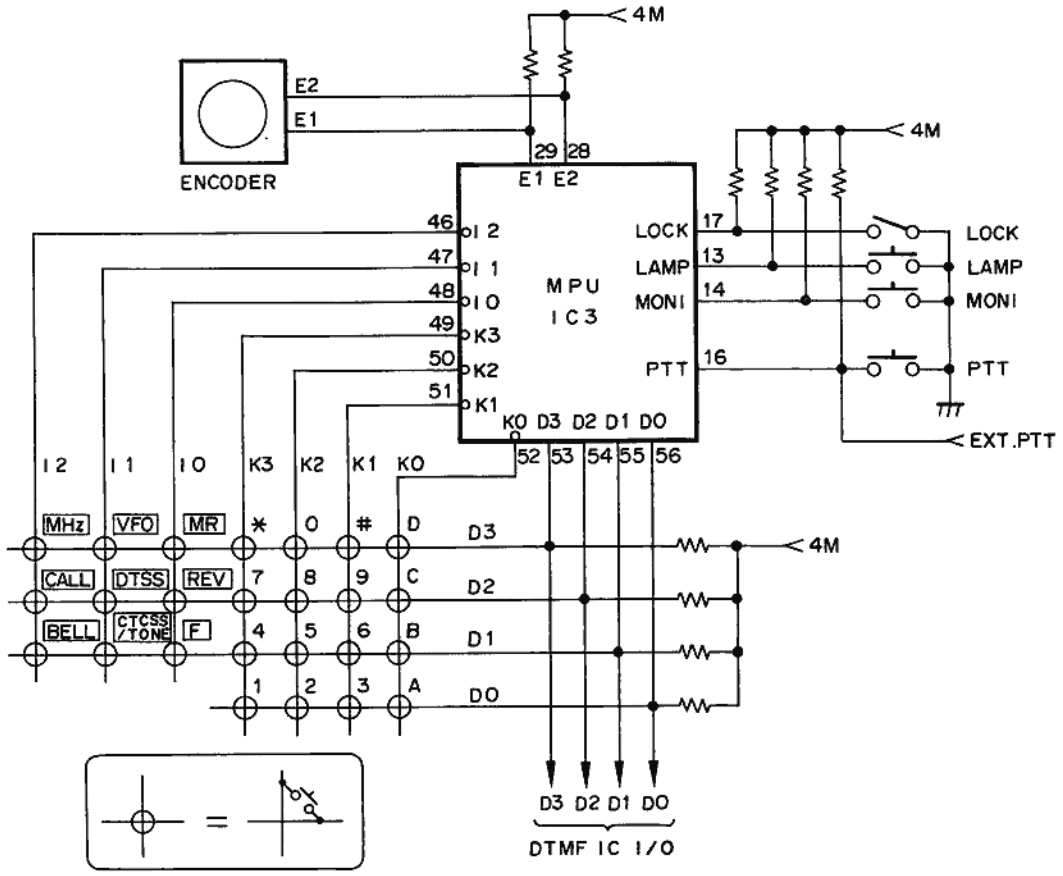


Fig. 10 Key, Encoder Input Circuit

CIRCUIT DESCRIPTION

2) Reset and backup circuit

When the power is switched on, reset circuit C23 and Q3 provides a low pulse of about 1 ms duration to reset the microprocessor. When the power is switched off, the backup detection IC IC4 detects the voltage drop in the 5V line, and changes the output level from high to low. When microprocessor port VF goes low, the microprocessor enters the backup mode.

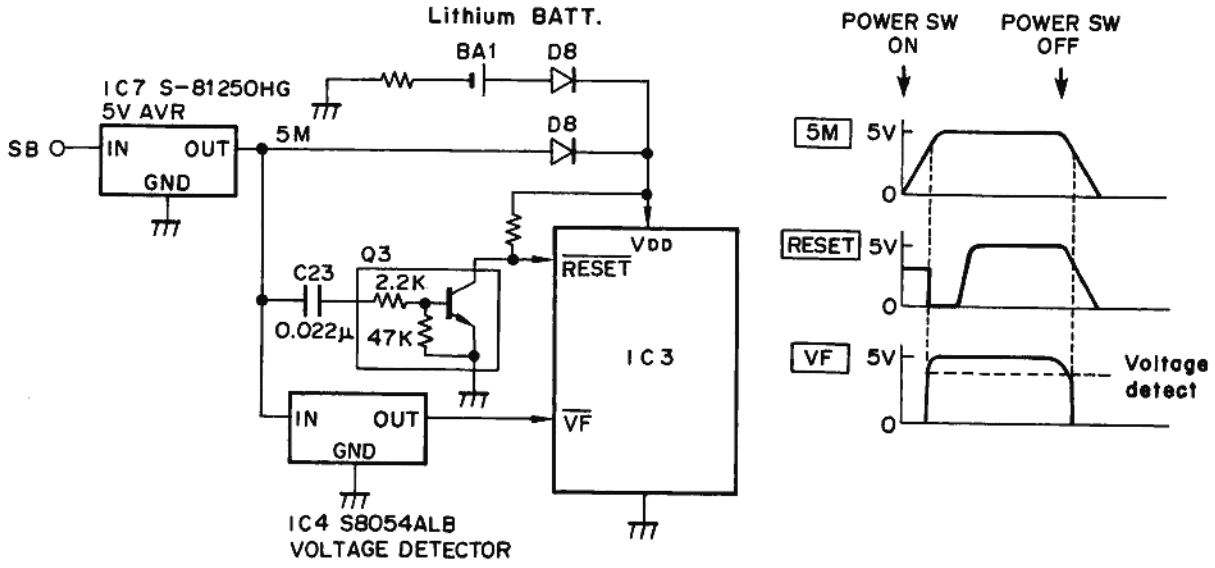


Fig. 11 Reset and Backup Circuit

3) Tone encode circuit

For the subtone, a tone signal of 67.0 to 250.3 Hz is generated by D/A converting the square waves output to B0 to B6 of IC3 by IC5. The signal passes through a low-pass filter R283 and C292 in the TX-RX unit, and is mixed with the microphone amplifier output, and modulated by the VCO circuit.

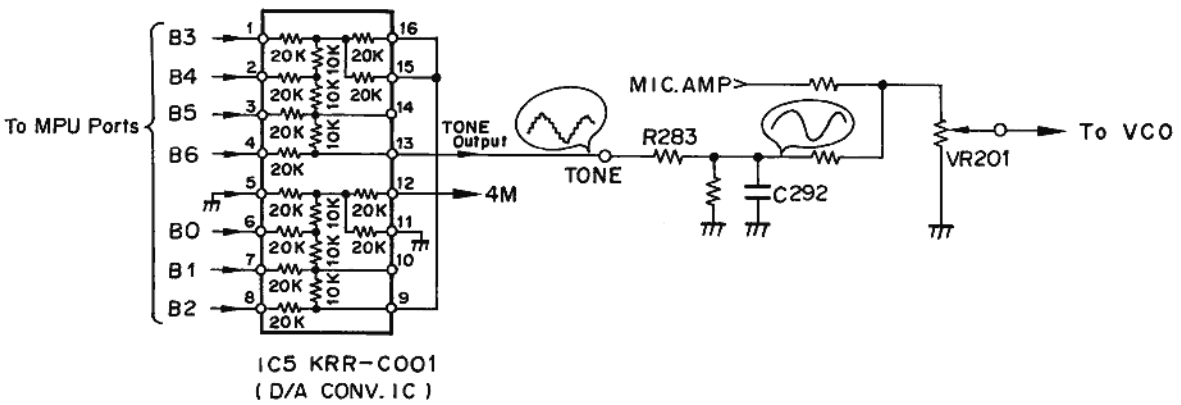


Fig. 12 Tone Encode Circuit

CIRCUIT DESCRIPTION

4) Battery voltage detection circuit

The battery voltage detection circuit divides the power supply voltage and inputs it to the analog port of the microprocessor. The voltage input to the microprocessor is A/D converted to control the BATT display of the LCD.

5) Lamp circuit

The LED is turned on and off by switching the 4M voltage with the output from the LAMP pin of the microprocessor

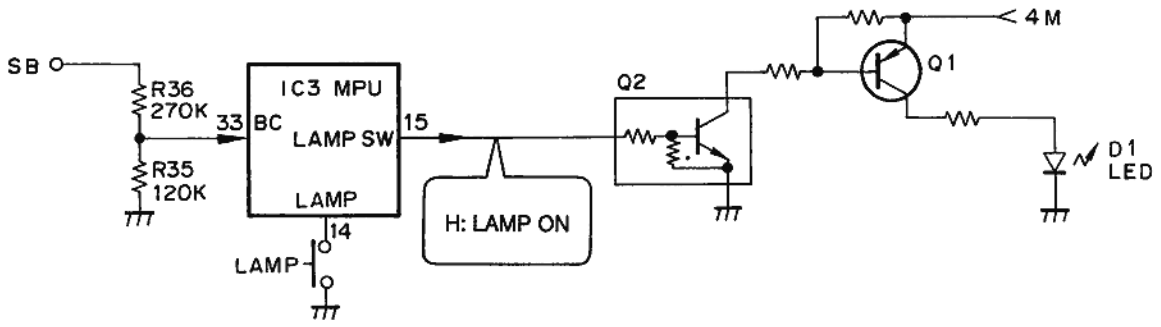


Fig. 13 Battery Voltage Detection Circuit and Lamp Circuit

6) Shift register circuit

Serial data is sent to the shift register IC (TX-RX unit IC203) from the microprocessor. The control output of the shift register is shown in Figure 14.

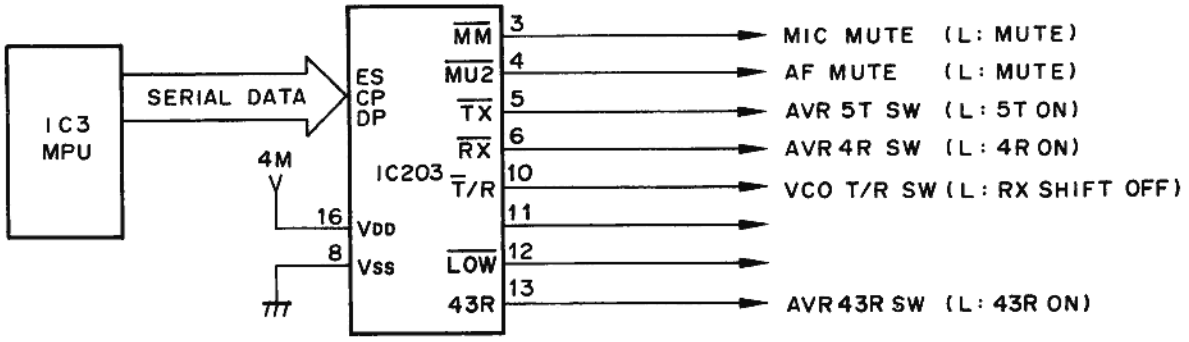


Fig. 14 Shift Resistor : IC203

CIRCUIT DESCRIPTION

6. Power Supply Circuits

1) Power switching circuit (The codes in brackets indicate pin names.)

The power switching circuit generates the 4.5V [4M] reference voltage by stabilizing the voltage at the DC IN pin or BATT pin with IC207 and Q216. The 5V [5T] output in transmit mode, the 4.5V [4R, 43R] output in receive mode, and the 4.5V [4C] output in both modes are generated by switching the 4M voltage via the microprocessor. IC7 in the control unit generates 5 V [5M] for the control circuit.

2) Battery save and automatic power off.

If no key is pressed for 10 seconds with squelch off, the power save circuit activated. Q220 is alternately turned on and off with a ratio of about 1:4 by the signal output from the SAVE pin of the microprocessor. The RX and 43R pins of IC203 are also turned on and off alternately. When the pins are off, Q207 and Q221 are off, the voltages for 4C, 4R, and 43R are not generated, and the current consumption is reduced. If no key is pressed for 60 minutes and squelch remains closed, the system enters the auto power off (APO) mode, and Q221 and Q207 go off.

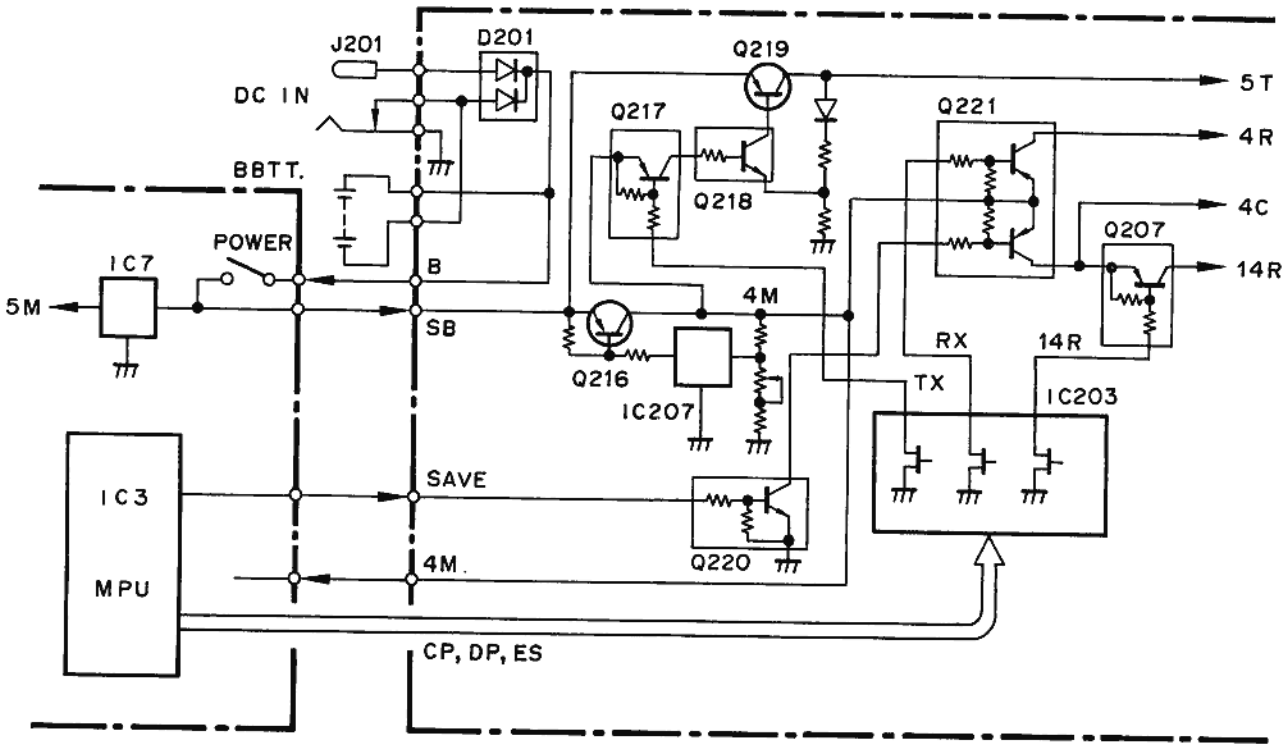


Fig. 15 Power Supply Circuit

CIRCUIT DESCRIPTION

7. Additional Circuits

1) CTCSS

The CTCSS circuit sets the tone frequency according to serial data from the microprocessor . The audio signal passes through the de-emphasis circuit and buffer amplifier Q213 and is applied to the RD pin by the detection output. When the tone matches, the SDO pin goes high. The microprocessor checks the SDO pin and controls the MUTE1 pin.

2) DTSS

The DTSS inputs and outputs DTMF codes according to parallel data from the microprocessor. The audio signal is input from the RD pin in the same way as with the CTCSS, and when a DTMF signal is detected, the data is sent to the microprocessor. The microprocessor checks the code, and controls the MUTE1 pin.

When the microprocessor sends a DTMF code corresponding to the numeric key input, the DTMF signal is sent from the IC and modulated by the microphone amplifier. When the DTMF signal is transmitted, the MM (microphone mute) pin of IC203 goes high to mute the audio signal from the microphone.

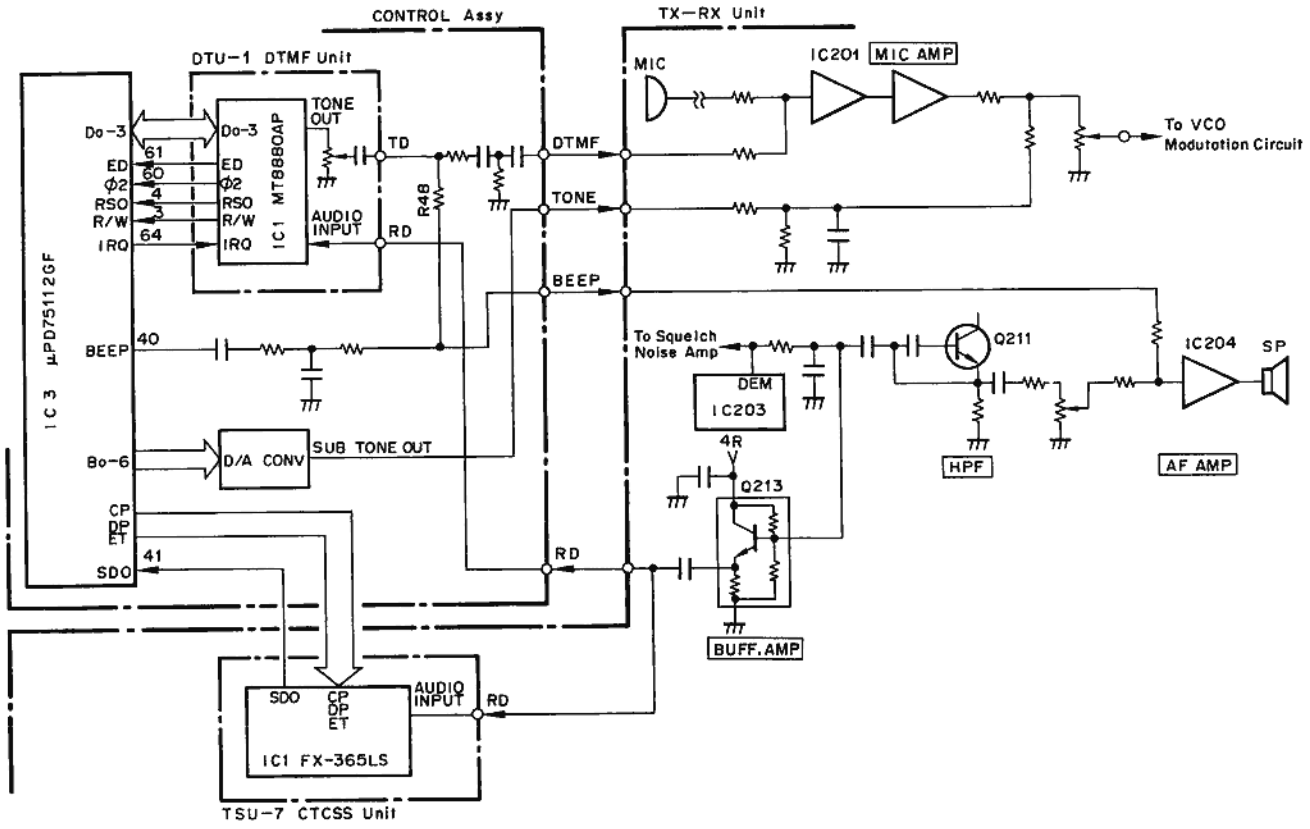


Fig. 16 Additional Circuits (DTMF, CTCSS, BEEP, TONE)

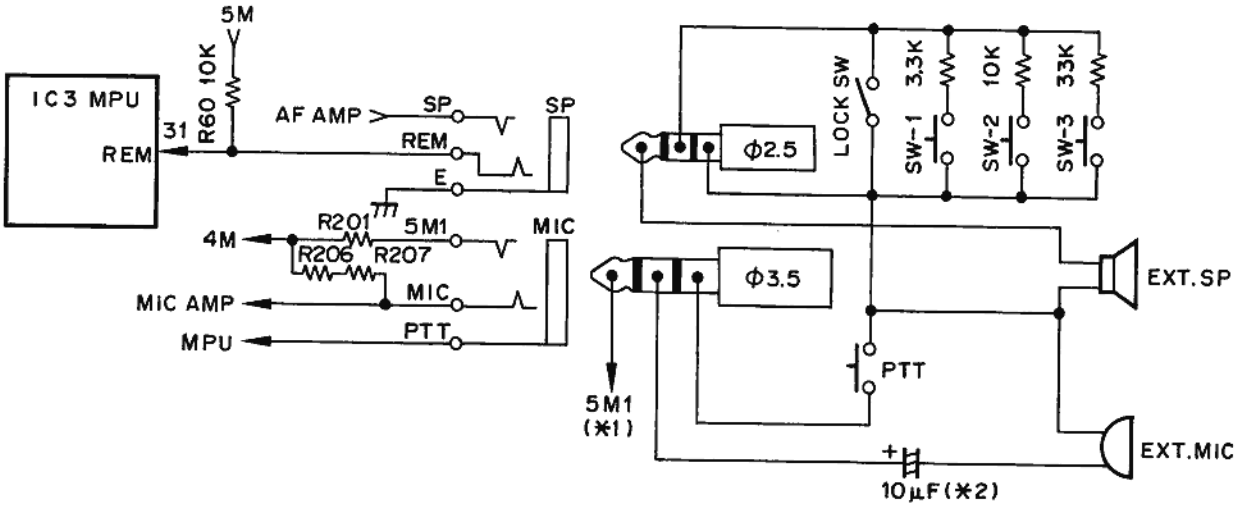
CIRCUIT DESCRIPTION

3) Remote control circuit

The remote control circuit A/D converts the voltage at the REM (remote) pin of the microprocessor and performs remote operations according to the voltage. The voltage at the REM pin is maintained at about 4.5 V by R60. When the switch on the remote control microphone is pressed, the voltage divided by the resistor in series with the switch and R60 appears and is used to determine which has been pressed.

4) 1750Hz tone circuit (E and T type only)

The microprocessor outputs 1750Hz square waves, which pass through low-pass filter R29 and C17, are mixed with the DTMF signal line, then fed to the microphone amplifier.



(*1) Voltage appears from the internal 4M line (4.5V) via R201

(*2) In the next case, the capacitor is not required.

Make the connection directly.

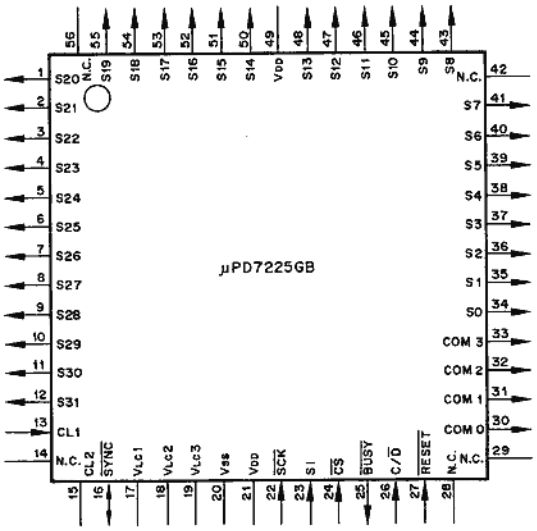
- In the case when a capacitor to cut DC voltage is connected to the external device
- In the case when a two-terminal condensor microphone is used as the external microphone

SEMICONDUCTOR DATA

1. LCD driver μPD7225GB-3B7 (Control Unit: IC2)

- Explanation of terminals

Pin No	Port name	I/O	Function
1~ 8	S20~S27	O	Segment drive signal output
9~12	S27~S31	-	Not used
13	CL1	-	R connection for CLOCK signal generation
14	NC	-	Not used
15	CL1	-	R connection for CLOCK signal generation
16	SYNC	-	Not used
17	VCL1	-	LCD driveing power supply
18	VCL2	-	LCD driveing power supply
19	VCL3	-	GND
20	VSS	-	GND
21	VDD	-	+4V
22	SCK	I	Shift clock input
23	SI	I	Serial data input
24	CS	I	Inable data input
25	BUSY	O	DATA input control
26	C/D	I	Command/data select input
27	RES	I	RESET input
28	NC	-	Not used
29	NC	-	Not used
30~32	COMO~COM2	O	Common signal output
33	COM3	-	Not used
34~41	SO~S7	O	Segment signal output
42	NC	-	Not used
43~48	S8~S13	O	Segment signal output
49	VDD	-	Not used
50~55	S14~S19	O	Segment signal output
56	NC	-	Not used



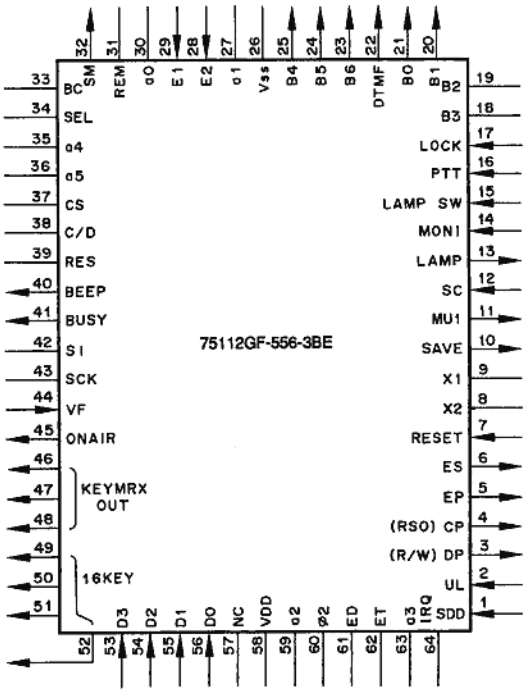
2. MPU 75112GF-556-3BE (Control Unit: IC3)

- Explanation of terminals

Pin No	Port name	I/O	Function
1	SDO	I	CTCSS tone DET. input: "L": same tone, "H": other
2	UL	I	PLL unlock DATA input: "L": lock, "H": unlock
3	DP	O	PLL, Tone and Shift resistor DATA output
4	CP	O	PLL, Tone and Shift resistor CLOCK output
5	EP	O	INABLE output (PLL)
6	ES	O	INABLE output (Shift resistor)
7	RESET	I	Reset voltage input
8	X2	I	CLOCK OSC.
9	X1	I	CLOCK OSC.
10	SAVE	O	Power save control data output
11	MU1	O	AF AMP control data output: "L": OFF, "H": ON
12	SC	I	BUSY data input: "H": BUSY
13	LAMP	O	LAMP control data output
14	MONI	I	MONI SW data input
15	LAMP SW	I	1750Hz TONE SW : "L": OFF, "H": ON
16	PTT	I	PTT SW data input : "L": PTT SW-OFF, "H": PTT SW-ON
17	LOCK	I	LOCK SW data input : "L": ON, "H": OFF
18	B3	O	Sub tone data output: bit3
19	B2	O	Sub tone data output: bit2
20	B1	O	Sub tone data output: bit1
21	B0	O	Sub tone data output: bit0
22	DTMF	O	DTMF data output
23	B6	O	Sub tone data output: bit6
24	B5	O	Sub tone data output: bit5
25	B4	O	Sub tone data output: bit4
26	VSS	-	GND
27	a1	I	Destination
28	E2	I	Encoder data input
29	E1	I	Encoder clock
30	a0	I	Destination
31	REM	I	Remote control data input
32	SM	I	S-meter analog data input
33	BC	I	BATT voltage analog data input (TX)
34	SEL	I	Destination
35	a4	I	Destination
36	a5	I	Destination
37	CS	O	Chip selecter for LCD driver IC
38	C/D	O	Command/Data switching for LCD driver IC
39	RES	O	Reset of LCD driver IC
40	BEEP	O	BEEP output
41	BUSY	O	BUSY control: "H" BUSY
42	SI	O	DATA for LCD driver IC
43	SCK	O	CLOCK for LCD driver IC

SEMICONDUCTOR DATA

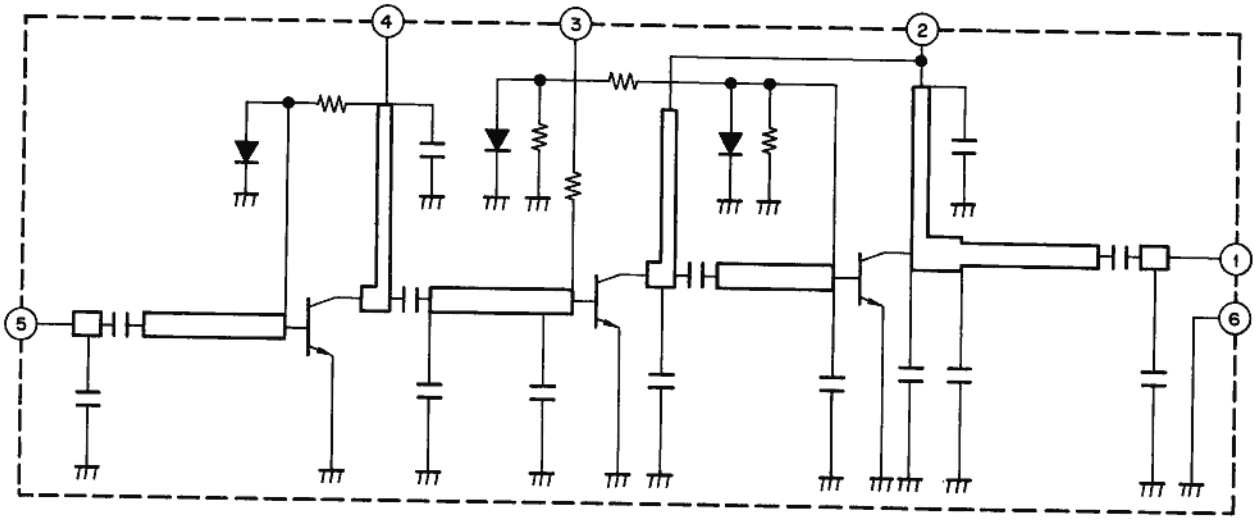
Pin No	Port name	I/O	Function
44	VF	I	BUCK-UP detection
45	ON AIR	O	LED control : "L" TX
46	KEYMRX OUT	O	KEY MATRIX data output
47			
48			
49	16KEY	O	KEY MATRIX data output (DTMF)
50			
51			
52			
53	D3	I	KEY MATRIX data input
54	D2		
55	D1		
56	D0		
57	NC	-	Open
58	VDD	-	+4V
59	a2	I	Destination
60	02	O	CLOCK for DTMF
61	ED	O	Inable for DTMF
62	ET	O	Inable for CTCSS
63	a3	I	Destination
64	IRQ	I	DTMF IC IRQ/CP



SEMICONDUCTOR DATA

3. Power module M67749MR

- Equivalent circuit diagram



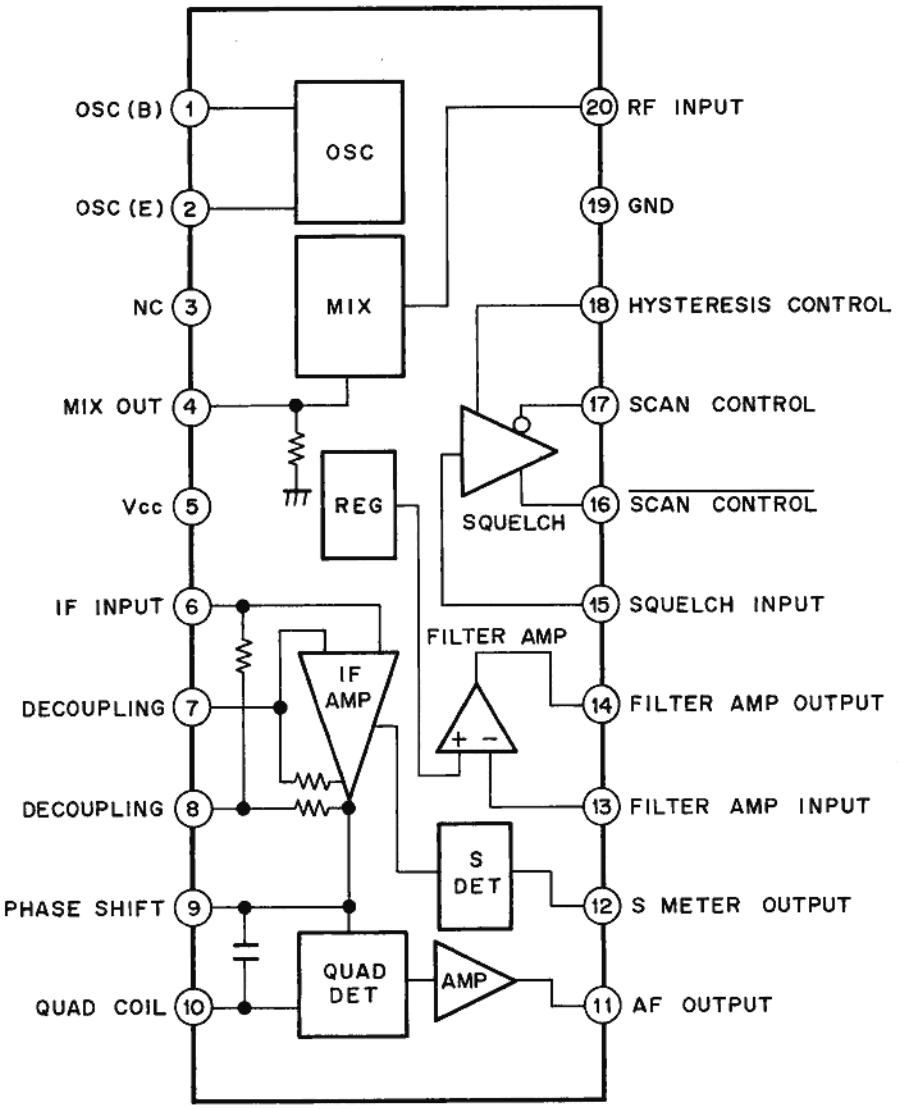
Electrode configuration
1. Output terminal
2. End power supply terminal
3. Base bias power supply terminal
4. First power supply terminal
5. Input terminal
6. Fin (earth)

- Electrical characteristics

Item	Symbol	Tc (°C)	Conditions	Standard Value			Unit
				Maxium	Standard	Manimum	
Frequency	f			430		450	MHz
Output power	Po	25	Vcc=12V, Vbb=5V, Pin=20mW, Zg=Zl=50Ω	7			W
Combined effeciency	μT	25	Same as above	40	45		%
Secondary spurious strength		25	Same as above			–25	dB
Tertiary spurious strength		25	Same as above			30	dB

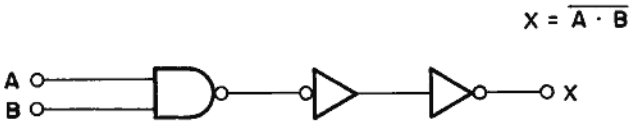
SEMICONDUCTOR DATA

4. FM signal process IC TK10486MT1 (TX-RX unit: IC205)

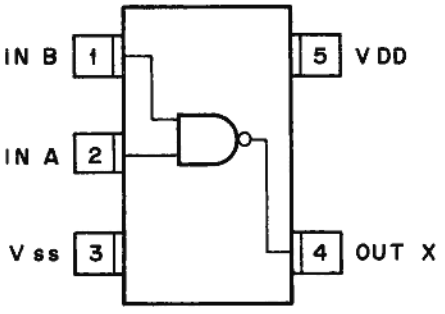


5. Unlock detection IC TC4S11F (TX-RX unit: IC3)

- Logic diagram



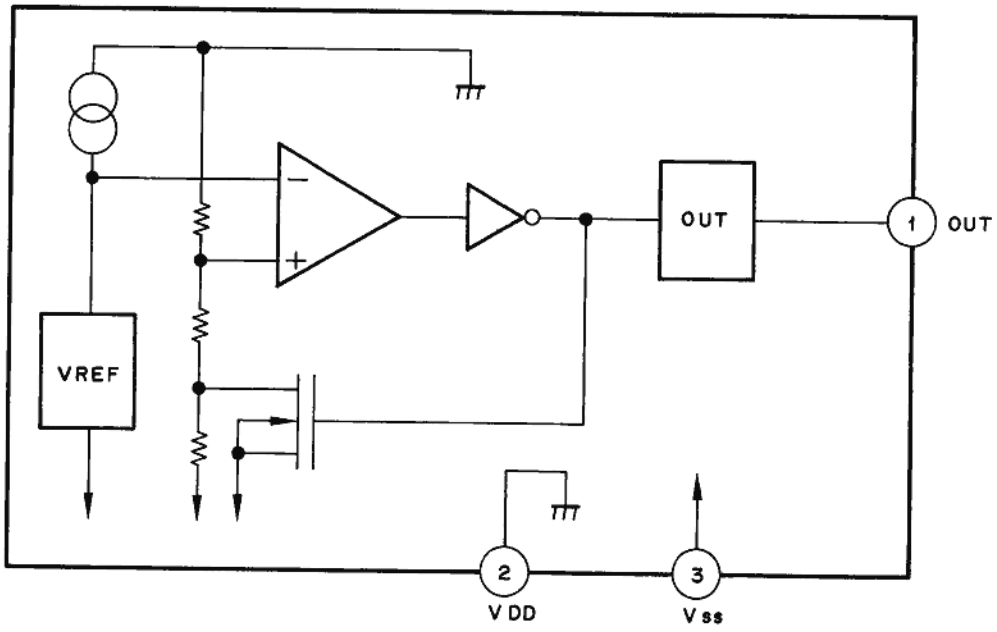
- Terminal connection diagram



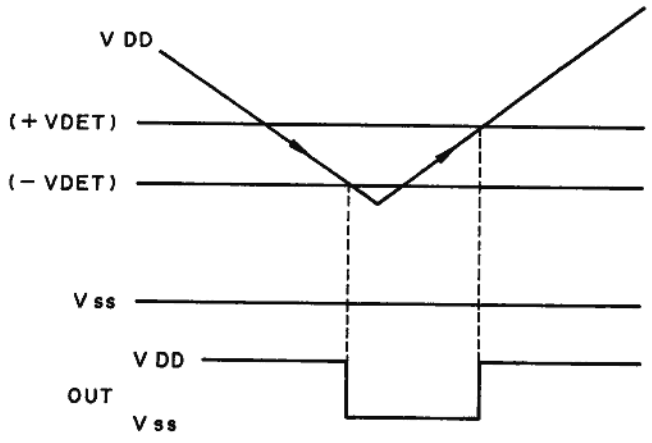
SEMICONDUCTOR DATA

6. Back-up detection IC S-8054ALR (Control ASSY: IC4)

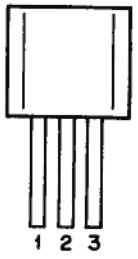
- Block diagram



- Timing chart



- Pin layout



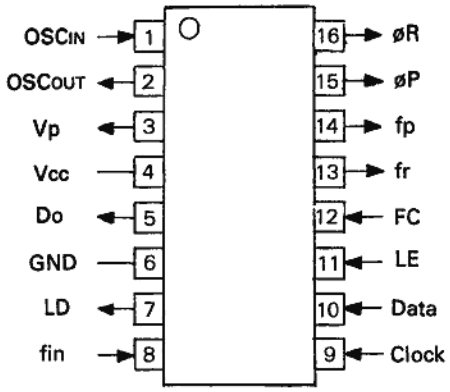
1 : OUT
2 : V DD
3 : V ss

BOTTOM VIEW

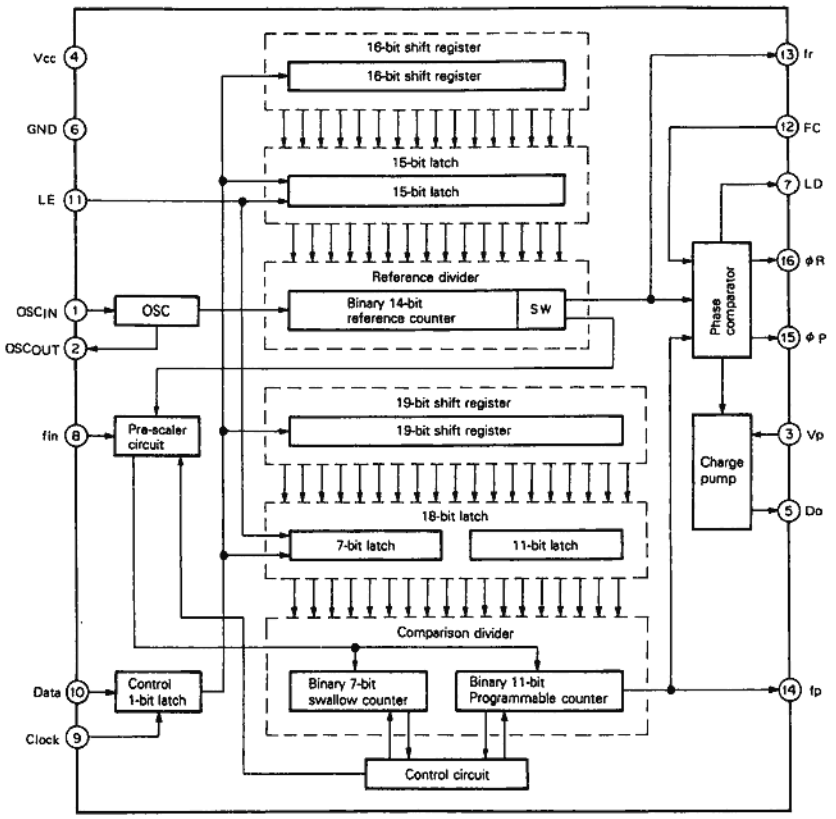
SEMICONDUCTOR DATA

7. PLL IC MB1504 (TX-RX unit: IC1)

- Terminal connection diagram



- Block diagram



- Explanation of terminals

Pin No.	Name	I/O	Function
1	OSCIN	I	Terminal for crystal connection.
2	OSCOUT	O	(OSCIN = Oscillator circuit input terminal, OSCOUT = Oscillator circuit output terminal)
3	VP	O	Power supply terminal for charge pump output.
4	Vcc	–	Power supply terminal.
5	Do	O	Charge pump output terminal. Phase characteristics are inverted according to the setting of the FC terminal.
6	GND	–	Ground terminal.
7	LD	O	Phase detector output terminal. Normally high. Low for the period of about the phase difference between fr and fp.
8	fin	I	Prescaler input terminal. Input with AC coupling.
9	Clock	I	Clock input input terminal for 19-bit and 16-bit shift register. Read data during rise of clock pulse.
10	Data	I	Serial data input terminal in binary code. When high, send data to 15-bit latch. When low, send data to 18-bit latch.
11	LE	I	Load enable signal input terminal. When high, send contents of shift register to latch (includes pull up resistor).
12	FC	I	Phase switch terminal of phase detector. When low, the charge pump and phase detector characteristics invert (includes pull up resistor).
13	fr	O	Monitor terminal of phase detector input. Output equivalent to reference divider.
14	fp	O	Monitor terminal of phase detector input. Output equivalent to programmable divider.
15	øP	O	Phase detector output terminal for external charge pump.
16	øR	O	Phase characteristics are inverted according to the setting of the FC terminal.

8. Shift resister MB88307FP (TX-RX unit: IC203)

- Input timing

(Ta = –40~+85°c, Vcc=5.0 V ±100%, Vss=0V)

Item	Symbol	Terminal	Condition	Rating		Unit
				Min.	Max.	
Reset signal pulse width	t_{w1}	$\overline{\text{Reset}}$	Fig. 1	100	—	ns
Load signal pulse width	t_{w2}	$\overline{\text{LOAD}}$	Fig. 1	200	—	ns
Shift clock frequency	f_C	sc	Fig. 2	—	2	MHz
Shift clock cycle time	t_{cyc}	sc	Fig. 2	0.5	—	µs
Shift clock pulse width	P_{WCH} P_{WCL}	sc	Fig. 2	200	—	ns
Shift clock rise time, fall time	t_{cr} t_{cf}	sc	Fig. 2	10	100	ns
Data input setup time	t_{su}	sl	Fig. 2	100	—	ns
Data input hold time	t_H	sl	Fig. 2	50	—	ns

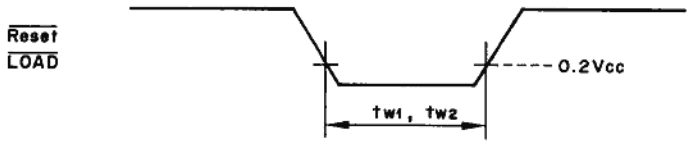


Fig. 1

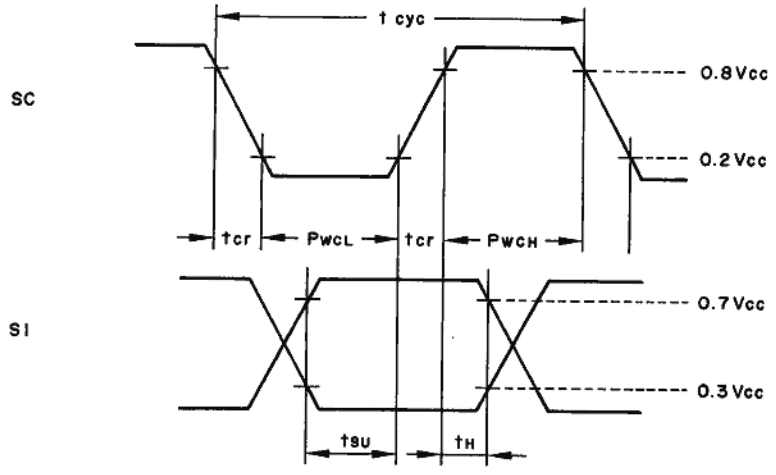


Fig. 2

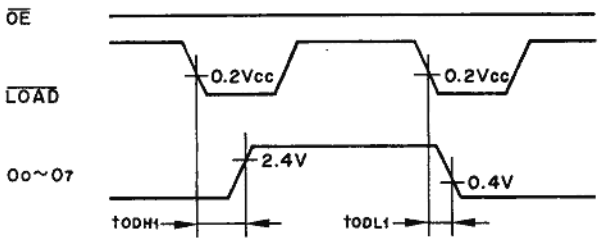
SEMICONDUCTOR DATA

- Output timing

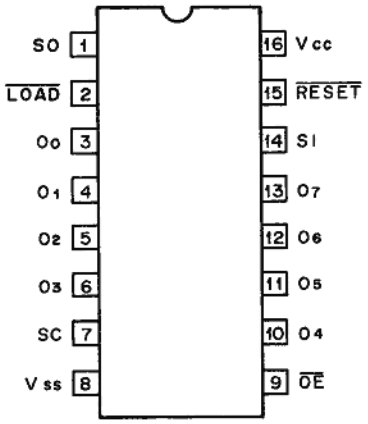
(T_a = –40 ~ +85°C, V_{CC} = 5.0V ±10%, V_{SS} = 0V)

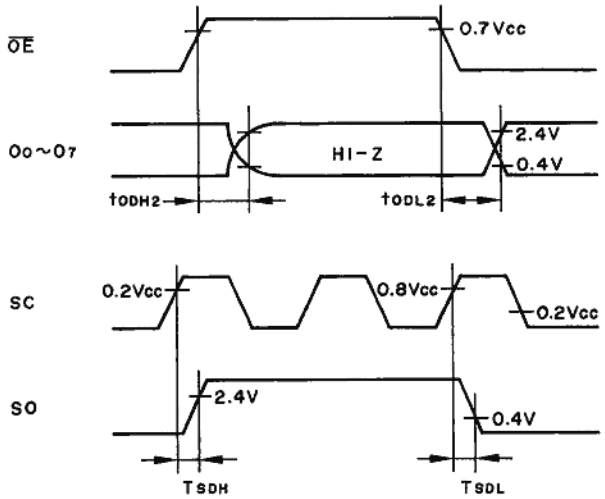
Item	Symbol	Terminal	Rating		Unit
			Min.	Max.	
0 port delay time	t_{ODH1}	0_0 ~ 0_7	—	500	ns
	t_{ODL1}		—	200	ns
	t_{ODH2}		—	500	ns
	t_{ODL2}		—	500	ns
Serial port dely time	t_{SDH}	S0	—	500	ns
	t_{SDL}		—	200	ns

Load : 50pF + 1.2kΩ



- Terminal layout (Top view)





TH-46A/AT/E

DESCRIPTION OF COMPONENTS

1. Control Ass'y (W09-****-05) 0893: K, M2, 0894: M, 0895: E, T, X

Element Number	Application/Operation	Operation/Condition/Interchangeability
IC2	LCD Driver	
IC3	MPU	See semiconductor DATA
IC4	Voltage Detecter	MPU Back up : 5M Voltage become 4.0 ~ 4.3 V or less
IC5	D/A Converter	Sub tone signal D/A converter
IC7	AVR	5M
Q1	LED Switching	ON when LAMP SW is pressed
Q2	LED Switching	ON when LAMP SW is pressed
Q3	MPU Reset	See circuit description Fig. 11
D1	LCD Light Up	ON when LAMP SW is pressed
D3	ON AIR Display	ON when TX
D4 ~ D6	Reverse Power Prevention	
D8	Reverse Power Prevention	

2. TX-RX unit (X57-3520-XX)

Element Number	Application/Operation	Operation/Condition/Intergeability
IC1	PLL	See semiconductor DATA
IC2	UNLOCK Detection	"H" when UNLOCK
IC201 (1/2)	MIC AMP	Limiter AMP
IC201 (2/2)	MIC AMP	Active LPF
IC203	Shift Register	See circuit description
IC204	AF AMP	Input Output
IC205	FM IC	See semiconductor DATA
IC206	Comparator	APC voltage control
IC207	4.5 [V] AVR	4M
Q1	VCO	
Q2	VCO Buff. AMP	
Q3	Lipple Filter	
Q4	RF AMP	
Q5	RF AMP	VCO AMP for RX
Q6	RF AMP	For TX
Q7, 8	Charge Pump	
Q9	RF AMP	For TX
Q10	RF AMP	TX drive AMP
Q13~Q18	E-Low Switching	See circuit description
Q20	1st IF AMP	1st IF : 30.825 MHz
Q21	1st Mixer	From 70cm BAND to 30.825 MHz
Q22, 23	RFAMP	70cm Band

DESCRIPTION OF COMPONENTS

Element Number	Application/Operation	Operation/Condition/Intergeability
Q27	E - Low Switching	See circuit description
Q28	TX - RX Switching	TX : ON
Q29	E - Low Switching	See circuit description
Q31	VCO Frequecy Shift	RX : ON
Q201	Constant Current	
Q207	43R Switching	RX : ON
Q208, Q209	AVR	For IC204 (AF, AMP)
Q210	AF Mute	See circuit description
Q211	HPF	
Q212	Noise AMP	SQ 1 noise AMP
Q213	AF AMP	For CTCSS, DTSS
Q214	TX power Switching	Low power : ON
Q215	TX power Switching	E-Low : OFF
Q216	AVR	4M
Q217	5T Switching	TX : ON
Q218, Q219	AVR	5T
Q220	4C Switching	See circuit description
Q221	4C, 4R Switching	See circuit description
Q222	TX Power Switchings	TX : ON
D1	Modulation	
D2	Frequency Shift	
D3, 4	VCO Voltage Control	
D5	Wareform Shaping	
D6	ATT	
D7	TX - RX Switching	TX : ON
D8	Temperature Compensation	Drive AMP Q10
D9	TX - RX Switching	TX : ON
D10, D11	RF Switching	
D12	Surge Voltage Absorption	
D15 ~ D17	Reverse Current Prevention	See circuit description
D18 ~ D19	E - Low Switching	See circuit description
D21	Charge Pump	PLL LPF
D201	Reverse Current Prevention	
D205	Reverse Voltage Protection	
D206	Reverse Current Prevention	
D207	Reference Voltage	8,2V
D208	SQ. Noise Detection	
D209	Reference Voltage	3,9V
	Voltage Shift	

TERMINAL FUNCTIONS

Connector No.	Terminal No.	Terminal name	I/O	Function
CONTROL UNIT (W02 – 089X – 05)				
CN1	CN1=C201 (TX-RX UNIT)			
CN2	1	RD	O	Af output
	2	IRQ	O	Interrupt to MPU
	3	TD	O	DTMF tone output
	4	D3	I	Key matrix
	5	5M	-	+ 5V
	6	D2	I	Key matrix
	7	R/W	I/O	DTMF data Read/ write
	8	D1	I	Key matrix
	9	RSO	I	Resister select
	10	DO	I	Key matrix
	11	.02	I	Clock
	12	E	-	GND
	13	ED	I	Inable
CN3	1	K3	O	Key matrix
	2	K2		
	3	K1		
	4	KO		
	5	SO	I	
	6	S1		
	7	S2		
	8	S3		
TX-RX UNIT (X,57 – 3520 – XX B/2)				
CN1	1	APC	I	APC voltage input
	2	CP	I	Clock (PLL)
	3	DP	I	Serial data (PLL)
	4	UL	I	Unlock signal "H" Unlock
	5	EP	I	Inable (PLL)
	6	MOD	I	MIC AMP output
	7	T/R	I	TX/RX swicthing "H" RX: "L" TX
	8	-		
	9	4C	I	+ 4V (Common)
	10	43R	I	+ 4V (RX)
	11	-	-	
	12	4R	I	+ 4V (RX)
	13	IF	O	RX 1st IF output
	14	5T	I	+5V (TX)
	15	E	-	GND
	16	E-Low	I	TX power switch "L" E-Low mode
CN2	1	FB	-	+B (Final module)
	2	E	-	GND

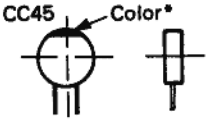
Connector No.	Terminal No.	Terminal name	I/O	Function
TX-RX UNIT (X57-3520-00 A/2)				
CN201	1	E	-	GND
	2	A2	I	AF input
	3	A1	O	AF output
	4	SQ	I	From SQ VR
	5	PTT	I	PTT line "H":TX, "L":RX
	6	SB	-	+B
	7	MIC	I	MIC AMP input
	8	SP	O	Internal SP
	9	REM	I	Remote control
	10	DTMF	I	DTMFtone(K. M. P. X) 1750Hz tone(E. T)
	11	TONE	I	CTCSS tone input
	12	SC	O	Busy signal "H" Busy
	13	SM	O	S-meter signal
	14	BEEP	I	BEEP signal input
	15	MUTE1	I	MUTE data "H" MUTE
	16	4M	-	+4V (For MPU)
	17	SAVE	I	SAVE data "L":SAVE, "H"normal
	18	B	-	+B
	19	E	-	GND
	20	ES	I	Sift resister inable
	21	UL	O	Unlock data
	22	EP	I	Inable (PLL)
	23	CP	I	Clock (PLL)
	24	DP	I	Serial data (PLL)
	25	ET	I	Inable (Tone)
	26	SDO	O	CTCSS tone DET. data
	27	RD	O	AF output for DTSS
	28	E-Low	I	TX power switch "L" E-Low mode
	29	LOW	I	TX power switch "L" Low power
	30	E	-	GND
CN202	CN202=CN1 (TX-RX unit X57-3520-XX B/2)			
CN203	1	ET	O	Inable for CTCSS
	2	NC	-	Not use
	3	DT	O	Serial data
	4	4C	O	+4V
	5	CT	O	Clock for CTCSS
	6	RD	O	AF output for CTCSS
	7	SDO	I	CTCSS DET. input
	8	E	-	GND
	9	TO	I	CTCSS tone input

PARTS LIST

CAPACITORS

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

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



- **Capacitor value**

0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001μF
1 0 3 = 0.01μF

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

- **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 10μF −10~+50 Less than 4.7μF −10~+75

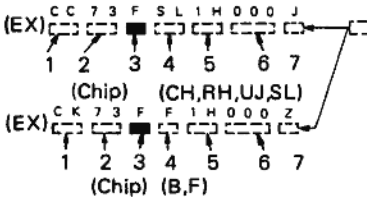
Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

- **Rating voltage**

1st word \ 2nd 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**

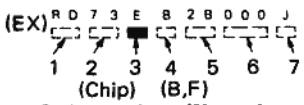


Dimension

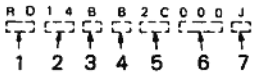
Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

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.

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				

Dimension

TH-46A/AT/E

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle 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	Destination 仕向	Remarks 備考
			TH-46A/AT/E			
0	3A, 3B		A01-1096-04	METALLIC CABINET		
1	1B	*	A02-0944-04	CASE ASSY	K	
1	1B	*	A02-0945-04	CASE ASSY	M1M2X	
1	1B	*	A02-0946-04	CASE ASSY	TE	
2	2A		A20-7065-04	PANEL ASSY		
3	2B		A20-7048-04	SWITCH COVER	M1M2X	
3	2B		A20-7049-04	PANEL ASSY	TE	
4	1B		A21-1535-04	DRESSING PANEL	MXTE	
5	2B		A40-0621-04	BOTTOM PLATE		
			B09-0312-04	CAP (PB-10)		
6	2A		B09-0318-03	CAP		
7	1A		B09-0319-04	CAP		
		*	B40-7630-04	MODEL NAME PLATE		
		*	B40-7631-04	MODEL NAME PLATE	M1M2	
		*	B40-7632-04	MODEL NAME PLATE	X	
		*	B40-7633-04	MODEL NAME PLATE	TE	
8			B42-3391-04	OPERATING CARD		
9			B46-0410-20	WARRANTY CARD	K	
9			B46-0419-00	WARRANTY CARD	E	
10		*	B50-8339-00	INSTRUCTION MANUAL		
13			E04-0168-15	RF COAXIAL CABLE RECEPTACLE		
14	2B		E23-0605-14	TERMINAL		
15	2B		E23-0638-04	TERMINAL		
16	3A		E23-0640-04	MOUNTING HARD WARE		
17	3A		E31-6126-05	FLAT CABLE		
18			F07-0896-13	COVER		
19	2A		F10-1423-04	SHIELDING PLATE		
19	2A	*	F10-1424-04	SHIELDING PLATE		
20	1B		F19-0650-04	BLIND PLATE		
			F20-0587-04	INSULATING BOARD (LITHUM BATT)		
21	3B	*	F20-0595-04	INSULATING BOARD		
22	3A		F29-0435-05	INSULATOR		
23	2B		G13-0852-04	CUTTION		
24			H11-0808-14	PACKING FIXTURE	TX	
24			H13-0823-04	PACKING FIXTURE	M1M2W	
25			H13-0818-04	BUFFER		
26		*	H13-0841-04	BUFFER	TEX	
27		*	H01-9631-04	ITEM CARTON BOX	K	
27		*	H01-9632-04	ITEM CARTON BOX	M1M2	
27		*	H01-9633-04	ITEM CARTON BOX	X	
27		*	H01-9634-04	ITEM CARTON BOX	TE	
28			H10-2688-02	POLYSTYRENE FOAMED FIXTURE		
30			H25-0085-04	PROTECTION BAG		
31	2B		J19-1426-03	HOLDER		
32		*	J21-4304-03	MOUNTING HARDWARE		
33	3B		J21-4290-04	MOUNTING HARDWARE		
34	1A		J21-4291-04	MOUNTING HARDWARE		
35	1B		J21-4292-04	MOUNTING HARDWARE		
36			J29-0424-04	BELT HOOK		
37	2B		J39-0434-04	SPACER		
38			J69-0312-04	HAND STRAP		

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

⚠ indicates safety critical components.

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
39	2A		J69-0321-05	0 RING		
40	3A		J69-0322-04	0 RING		
41	2A		K29-4547-04	KN0B ASSY (AF V0L)		
42	2A		K29-4548-04	KN0B (SQ)		
43	2A		K29-4549-04	KN0B (ENC0DER)		
44	2B		K29-4550-04	KN0B (H/L)		
45	1B		K29-4551-04	KN0B (F L0CK)		
46	2B		K29-4552-03	KN0B (PTT)		
47	2A		K29-4553-04	KYE T0P		
48	2A		K29-4554-04	KYE T0P		
49	2B		K29-4564-04	KN0B (RELEASE)		
A			N09-2025-05	SCREW		
B			N09-2028-05	SCREW		
C			N09-2064-05	SCREW		
D			N09-2086-05	SCREW		
E			N09-2087-05	SCREW		
F			N14-0545-04	NUT		
G			N35-2003-41	BINDING HEAD MACHINE SCREW		
H			N35-2003-45	BINDING HEAD MACHINE SCREW		
I			N35-2605-41	BINDING HEAD MACHINE SCREW		
50	2A		R23-9403-05	TRIM P0T. 50K/10K (AF,SQ)		
SP1	1A		T07-0257-05	L0UDSPEAKER(FULLRANGE)		
51			T90-0406-05	ANTENNA		
52	2B		T91-0381-05	MICR0PH0NE		
IC1			M67749MR	IC(P0WER M0DULE)		
53	2A		W02-1601-05	C0NTR0L UNIT		
54	2A,2B	*	W02-0893-05	C0NTR0L UNIT	KM2	
54	2A,2B	*	W02-0894-05	C0NTR0L UNIT	M	
54	2A,2B	*	W02-0895-05	C0NTR0L UNIT	TEX	
-			X52-3160-00	DTMF UNIT	K	
55	2A,2B	*	X57-3520-11	TX-RX UNIT	KM2	
55	2A,2B	*	X57-3520-21	TX-RX UNIT	MTEX	
58			E19-0254-05	AC PLUG (ACCY)	M1M2	
59			H11-0840-04	BUFFER	M1M2	
60			W09-0535-05	BATTERY PACK (PB-10)		
61			W09-0315-25	BATTERY CHARGER (120V)	K	
61			W09-0317-15	BATTERY CHARGER (220V)	E	
61			W09-0318-15	BATTERY CHARGER (240V)	T	
61			W09-0522-05	BATTERY CHARGER (240V)	X	
61			W09-0534-05	BATTERY CHARGER (120/230V)	M1M2	
-			W09-0394-05	LITHUM BATTERY		
-			W03-2015-05	DTMF KEY B0ARD ASSY	K	

TX-RX UNIT (X57-3520-XX)

C1			CC73GCH1H101J	CHIP C	100PF	J	
C2		*	CC73GCH1H0R3B	CHIP C	0.3PF	B	
C3 -5			CC73GCH1H101J	CHIP C	100PF	J	
C6		*	CC73GCH1H2R5B	CHIP C	2.5PF	B	
C7 ,8			CC73GCH1H101J	CHIP C	100PF	J	
C9			CC73GCH1H1R5C	CHIP C	1.5PF	C	
C10			CC73GCH1H101J	CHIP C	100PF	J	

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

⚠ indicates safety critical components.

TH-46A/AT/E

PARTS LIST

＊ New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Teile ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格			Destination 仕向	Remarks 備考
C11		*	CC73GUJ1H050C	CHIP C	5PF	C		
C12		*	CC73GUJ1H040C	CHIP C	4PF	C		
C13			CC73GCH1H0R5C	CHIP C	0.5PF	C		
C14 ,15			CC73GCH1H101J	CHIP C	100PF	J		
C16			C92-0507-05	CHIP-TAN	4.7UF	6.3WV		
C17			CC73GCH1H101J	CHIP C	100PF	J		
C18			C92-0003-05	CHIP-TAN	0.47UF	25WV		
C19			C92-0005-05	CHIP-TAN	2.2UF	6.3WV		
C20		*	CK73FB1E104K	CHIP C	0.10UF	K		
C21			CC73GCH1H030C	CHIP C	3PF	C		
C22 ,23			CC73GCH1H101J	CHIP C	100PF	J		
C24 ,25			CC73GCH1H080D	CHIP C	8PF	D		
C26			CC73GCH1H101J	CHIP C	100PF	J		
C27			CC73GCH1H080D	CHIP C	8PF	D		
C28			CC73GCH1H101J	CHIP C	100PF	J		
C29			CC73GCH1H080D	CHIP C	8PF	D		
C30			CC73GCH1H101J	CHIP C	100PF	J		
C31			C92-0507-05	CHIP-TAN	4.7UF	6.3WV		
C32 ,33			CC73GCH1H330J	CHIP C	33PF	J		
C34		*	CK73FB1E104K	CHIP C	0.10UF	K		
C35 ,36			CC73GCH1H101J	CHIP C	100PF	J		
C37 ,38			CK73GB1H471K	CHIP C	470PF	K		
C39			CK73GB1H102K	CHIP C	1000PF	K		
C40			CC73GCH1H040C	CHIP C	4PF	C		
C41 ,42			CK73GB1H471K	CHIP C	470PF	K		
C43		*	CK73FB1E473K	CHIP C	0.047UF	K		
C44 ,45			CK73GB1H471K	CHIP C	470PF	K		
C46			CK73GB1H102K	CHIP C	1000PF	K		
C47 -49			CK73GB1H471K	CHIP C	470PF	K		
C50			CK73GB1H102K	CHIP C	1000PF	K		
C51			C92-0038-05	ELECTRO	22UF	16WV		
C52			CK73GB1H471K	CHIP C	470PF	K		
C53			CK73GB1H102K	CHIP C	1000PF	K		
C54			C92-0045-05	ELECTRO	22UF	6.3WV		
C55			CK73GB1H471K	CHIP C	470PF	K		
C57			CK73FB1E473K	CHIP C	0.047UF	K		
C58		*	C92-0040-05	ELECTRO	47UF	16WV		
C59			CK73GB1H471K	CHIP C	470PF	K		
C63			CC73GCH1H050C	CHIP C	5PF	C		
C64			CC73GCH1H220J	CHIP C	220PF	J		
C65			CC73GCH1H050C	CHIP C	5PF	C		
C66			CC73GCH1H090D	CHIP C	9PF	D		
C67			CC73GCH1H150J	CHIP C	15PF	J		
C68			CC73GCH1H090D	CHIP C	9PF	D		
C69			CC73GCH1H080D	CHIP C	8PF	D		
C70			CC73GCH1H120J	CHIP C	12PF	J		
C71			CC73GCH1H050C	CHIP C	5PF	C		
C73			CC73GCH1H101J	CHIP C	100PF	J		
C74 ,75			CK73GB1H471K	CHIP C	470PF	K		
C76			CC73GCH1H101J	CHIP C	100PF	J		
C77 ,78			CK73GB1H102K	CHIP C	1000PF	K		
C81			CK73GB1H102K	CHIP C	1000PF	K		
C84			CK73GB1H102K	CHIP C	1000PF	K		
C86			CK73GB1H102K	CHIP C	1000PF	K		
C87			CC73GCH1H060D	CHIP C	6PF	D		

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

⚠ indicates safety critical components.

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
C88			CC73GCH1H270J	CHIP C 27PF J		
C89			CK73GB1H102K	CHIP C 1000PF K		
C90			CK73GB1H103K	CHIP C 0.01UF K		
C91			CC73GCH1H101J	CHIP C 100PF J		
C92			CC73GCH1HR75C	CHIP C 0.75PF C		
C93 -97			CC73GCH1H101J	CHIP C 100PF J		
C98			CK73GB1H471K	CHIP C 470PF K		
C99			CC73GCH1H101J	CHIP C 100PF J		
C100			CC73GCH1H470J	CHIP C 47F J		
C101			CC73GCH1H101J	CHIP C 100PF J		
C102			CC73GCH1H010C	CHIP C 1PF C		
C107			CC73GCH1H010C	CHIP C 1PF C		
C108		*	CK73GR1C223K	CHIP C 0.022UF K		
C117,118			CK73GB1H471K	CHIP C 470PF K		
C120,121			CC73GCH1H101J	CHIP C 100PF J		
C127,128			CC73GCH1H101J	CHIP C 100PF J		
C129			CK73GB1H102K	CHIP C 1000PF K		
C150			CK73FB1E473K	CHIP C 0.047UF K		
C151-154			CC73GCH1H101J	CHIP C 100PF J		
C201-205			CC73GCH1H101J	CHIP C 100PF J		
C206-209			CC73GCH1H101J	CHIP C 100PF J		
C210			CK73FF1E154Z	CHIP C 0.15UF Z		
C211			CC73GCH1H101J	CHIP C 100PF J		
C212			CE04NW1C101M	ELECTR® 100UF 16WV		
C213			C92-0507-05	CHIP-TAN 4.7UF 6.3WV		
C214			CK73GB1H102K	CHIP C 1000PF K		
C215		*	C92-0518-05	CHIP-TAN 0.22UF 8WV		
C216			CK73FB1H223K	CHIP C 0.022UF K		
C217			CC73GCH1H101J	CHIP C 100PF J		
C218			C92-0507-05	CHIP-TAN 4.7UF 6.3WV		
C219			CK73GB1H103K	CHIP C 0.01UF K		
C220			C92-0517-05	CHIP-TAN 2.2UF 4WV		
C221			CC73GCH1H101J	CHIP C 100PF J		
C222			CK73GB1H103K	CHIP C 0.01UF K		
C223			CC73GCH1H151J	CHIP C 150PF J		
C224			CK73GB1H182K	CHIP C 1800PF K		
C225			CK73GB1H103K	CHIP C 0.01UF K		
C226			C92-0507-05	CHIP-TAN 4.7UF 6.3WV		
C227			CK73FB1E473K	CHIP C 0.047UF K		
C228			CK73EF1E334Z	CHIP C 0.33UF Z		
C229			CK73GB1H102K	CHIP C 1000PF K		
C231		*	C92-0521-05	CHIP-TAN 0.47UF 20WV		
C237			CC73GCH1H101J	CHIP C 100PF J		
C238			C92-0004-05	CHIP-TAN 1.0UF 16WV		
C239			CK73GB1H103K	CHIP C 0.01UF K		
C240			CC73GCH1H101J	CHIP C 100PF J		
C241		*	C92-0040-05	ELECTR® 47UF 16WV		
C242			C90-2052-05	ELECTR® 68UF 10WV		
C243		*	C92-0047-05	ELECTR® 47UF 6.3WV		
C244			C92-0513-05	CHIP-TAN 3.3UF 6.3WV		
C245			CK73FB1E473K	CHIP C 0.047UF K		
C248			CK73FB1H273K	CHIP C 0.027UF K		
C249			C92-0045-05	ELECTR® 22UF 6.3WV		
C250,251			CK73FB1H223K	CHIP C 0.022UF K		
C252			C92-0004-05	CHIP-TAN 1.0UF 16WV		

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

⚠ indicates safety critical components.

TH-46A/AT/E

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
C253			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C254			CK73FB1H223K	CHIP C 0.022UF K		
C255			CK73GB1H102K	CHIP C 1000PF K		
C256		*	CK73FB1E104K	CHIP C 0.10UF K		
C257-260			CK73GB1H102K	CHIP C 1000PF K		
C261			C92-0001-05	CHIP-TAN 0.1UF 35WV		
C262			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C263			CK73GB1H102K	CHIP C 1000PF K		
C264			CC73GCH1H390J	CHIP C 39PF J		
C265			CC73GCH1H470J	CHIP C 47F J		
C266,267		*	CK73FB1E104K	CHIP C 0.10UF K		
C268			CC73GCH1H820J	CHIP C 82PF J		
C269		*	CK73FB1E104K	CHIP C 0.10UF K		
C270			C90-2050-05	ELECTRO 33UF 6.3WV		
C271,272		*	CK73FB1E104K	CHIP C 0.10UF K		
C273			CC73GCH1H101J	CHIP C 100PF J		
C275			CC73GCH1H151J	CHIP C 150PF J		
C276		*	C92-0519-05	CHIP-TAN 1UF 25WV		
C279			CK73GB1H102K	CHIP C 1000PF K		
C280			CK73FB1E473K	CHIP C 0.047UF K		
C281			CC73GCH1H101J	CHIP C 100PF J		
C282			CK73GB1H103K	CHIP C 0.01UF K		
C283-286			CC73GCH1H101J	CHIP C 100PF J		
C287		*	C92-0047-05	ELECTRO 47UF 6.3WV		
C288			CC73GCH1H101J	CHIP C 100PF J		
C289			C92-0045-05	ELECTRO 22UF 6.3WV		
C290,291			CC73GCH1H101J	CHIP C 100PF J		
C292		*	CK73FB1E183K	CHIP C 0.018UF K		
C294-295			CC73GCH1H101J	CHIP C 100PF J		
C296-298			CC73GCH1H101J	CHIP C 100PF J		
TC1 ,2			C05-0371-05	TRIMMER 10PF		
CN1			E40-5224-05	FLAT CABLE CONNECTOR		
CN2			E40-5179-05	PIN ASSY		
CN201			E40-5247-05	FLAT CABLE CONNECTOR		
CN202			E40-5224-05	FLAT CABLE CONNECTOR		
CN203			E40-5343-05	PIN CONNECTOR (CTCSS)		
J201		*	E03-0170-05	DC JACK		
J202			E11-0429-05	EXT.MIC JACK		
J203		*	E11-0439-05	EXT.SP JACK		
TP4		*	E23-0342-05	TERMINAL		
TP201		*	E23-0342-05	TERMINAL		
W201		*	E31-6119-15	CONNECTING WIRE		
		*	F10-1425-03	SHIELDING PLATE (PLL)		
		*	F10-1426-04	SHIELDING PLATE (VCO)		
		*	F10-1427-04	SHIELDING PLATE (LPF)		
			J30-0545-05	SPACER		
CD201			L79-0817-05	CRYSTAL DISC.		
CF201			L72-0362-05	CERAMIC FILTER (455KHZ)		
L1		*	L34-2362-05	COIL		
L2		*	L40-4782-19	SMALL FIXED INDUCTOR		
L3 ,4			L40-1881-80	SMALL FIXED INDUCTOR		
L5 ,6			L40-1872-48	SMALL FIXED INDUCTOR		

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

⚠ indicates safety critical components.

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
L8			L34-1266-05	COIL		
L9			L92-0130-05	CHIP COIL		
L10			L40-1872-48	SMALL FIXED INDUCTOR		
L11			L40-1092-48	SMALL FIXED INDUCTOR		
L12			L92-0130-05	CHIP COIL		
L13			L34-1227-05	COIL		
L14 ,15			L34-1213-05	COIL		
L16 ,17			L34-1212-05	COIL		
L19			L40-1072-48	SMALL FIXED INDUCTOR		
L21			L40-1872-48	SMALL FIXED INDUCTOR		
L22			L40-1092-48	SMALL FIXED INDUCTOR		
L23			L79-0815-05	HELICAL COIL		
L24			L40-1872-48	SMALL FIXED INDUCTOR		
L25			L79-0818-05	HELICAL COIL		
L26			L40-1872-48	SMALL FIXED INDUCTOR		
L28			L40-1092-48	SMALL FIXED INDUCTOR		
L29			L34-1213-05	COIL		
L30			L92-0130-05	CHIP COIL		
L31			L34-1273-05	COIL		
L32			L92-0130-05	CHIP COIL		
L33		*	L40-4782-19	SMALL FIXED INDUCTOR		
L201		*	L39-0485-05	COIL		
L202			L40-1092-19	SMALL FIXED INDUCTOR		
X1			L77-1358-05	CRYSTAL RESONATOR (12.8MHZ)		
X201			L77-1356-05	CRYSTAL RESONATOR (30.370MHZ)		
XF1			L71-0263-05	MCF (30.825MHZ)		
R2			RK73GB1J104J	CHIP R 100K J 1/16W		
R3 -5			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R6			RK73EB2B101J	CHIP R 100 J 1/8W		
R8			RK73GB1J470J	CHIP R 47 J 1/16W		
R9			RK73GB1J101J	CHIP R 100 J 1/16W		
R10			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R11			RK73GB1J563J	CHIP R 56K J 1/16W		
R12			RK73GB1J471J	CHIP R 470 J 1/16W		
R13			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R14			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R15			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R16			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R17			RK73GB1J104J	CHIP R 100K J 1/16W		
R18			RK73GB1J471J	CHIP R 470 J 1/16W		
R19			RK73GB1J124J	CHIP R 120K J 1/16W		
R20			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R21			RK73GB1J473J	CHIP R 47K J 1/16W		
R22			RK73GB1J471J	CHIP R 470 J 1/16W		
R23			RK73GB1J331J	CHIP R 330 J 1/16W		
R24			RK73GB1J103J	CHIP R 10K J 1/16W		
R25 ,26			RK73GB1J223J	CHIP R 22K J 1/16W		
R27			RK73GB1J103J	CHIP R 10K J 1/16W		
R28			RK73GB1J104J	CHIP R 100K J 1/16W		
R29 -31			RK73GB1J473J	CHIP R 47K J 1/16W		
R32			RK73GB1J392J	CHIP R 3.9K J 1/16W		
R33			R92-1252-05	CHIP R 0 OHM		
R34			RK73GB1J223J	CHIP R 22K J 1/16W		
R35			R92-1252-05	CHIP R 0 OHM		

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

⚠ indicates safety critical components.

TH-46A/AT/E

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R36			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R37			RK73GB1J103J	CHIP R 10K J 1/16W		
R39			RK73GB1J682J	CHIP R 6.8K J 1/16W		
R40			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R41		*	RK73GB1J150J	CHIP R 15 J 1/16W		
R42			RK73GB1J560J	CHIP R 56 J 1/16W		
R43			RK73GB1J561J	CHIP R 560 J 1/16W		
R44 ,45			R92-1252-05	CHIP R 0 OHM		
R46			RK73GB1J681J	CHIP R 680 J 1/16W		
R47			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R48			RK73GB1J270J	CHIP R 27 J 1/16W		
R50			RK73GB1J681J	CHIP R 680 J 1/16W		
R51 ,52			RK73GB1J271J	CHIP R 270 J 1/16W		
R53 ,54			RK73GB1J151J	CHIP R 150 J 1/16W		
R57			R92-1252-05	CHIP R 0 OHM		
R59			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R60			RK73GB1J101J	CHIP R 100 J 1/16W		
R61			RK73GB1J473J	CHIP R 47K J 1/16W		
R62			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R63			R92-1252-05	CHIP R 0 OHM		
R64			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R65			R92-1252-05	CHIP R 0 OHM		
R66			RK73GB1J334J	CHIP R 330K J 1/16W		
R67			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R68			R92-1252-05	CHIP R 0 OHM		
R69			RK73GB1J561J	CHIP R 560 J 1/16W		
R70			RK73GB1J154J	CHIP R 150K J 1/16W		
R71 ,72			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R73			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R74			RK73GB1J391J	CHIP R 390 J 1/16W		
R75			RK73GB1J270J	CHIP R 27 J 1/16W		
R76			RK73GB1J154J	CHIP R 150K J 1/16W		
R77			RK73GB1J471J	CHIP R 470 J 1/16W		
R78			RK73GB1J220J	CHIP R 22 J 1/16W		
R79			RK73GB1J104J	CHIP R 100K J 1/16W		
R80 ,81			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R83			RK73GB1J101J	CHIP R 100 J 1/16W		
R90			RK73GB1J681J	CHIP R 680 J 1/16W		
R91			RK73GB1J391J	CHIP R 390 J 1/16W		
R92			R92-1252-05	CHIP R 0 OHM		
R93			RK73GB1J473J	CHIP R 47K J 1/16W		
R95 -99			R92-1252-05	CHIP R 0 OHM		
R100		*	R90-0714-05	MULTI-COMP 10KX4		
R101			R92-1252-05	CHIP R 0 OHM		
R102			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R103			R92-1252-05	CHIP R 0 OHM		
R201,202			RK73GB1J101J	CHIP R 100 J 1/16W		
R203			RK73GB1J823J	CHIP R 82K J 1/16W		
R204			RK73GB1J473J	CHIP R 47K J 1/16W		
R205			RK73GB1J100J	CHIP R 10 J 1/16W		
R206			RK73GB1J471J	CHIP R 470 J 1/16W		
R207			RK73GB1J182J	CHIP R 1.8K J 1/16W		
R208			RK73GB1J272J	CHIP R 2.7K J 1/16W		
R209			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R210			RK73GB1J224J	CHIP R 220K J 1/16W		

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

⚠ indicates safety critical components.

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R211			RK73GB1J103J	CHIP R 10K J 1/16W		
R212			RK73GB1J223J	CHIP R 22K J 1/16W		
R213			RK73GB1J273J	CHIP R 27K J 1/16W		
R214			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R215			RK73GB1J391J	CHIP R 390 J 1/16W		
R216			RK73GB1J154J	CHIP R 150K J 1/16W		
R217,218			RK73GB1J104J	CHIP R 100K J 1/16W		
R219			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R220			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R221			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R222			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R223			RK73GB1J563J	CHIP R 56K J 1/16W		
R224			RK73GB1J153J	CHIP R 15K J 1/16W		
R225			RK73GB1J223J	CHIP R 22K J 1/16W		
R226			R92-1252-05	CHIP R 0 ΩHM		
R227			RK73GB1J224J	CHIP R 220K J 1/16W		
R232			RK73GB1J153J	CHIP R 15K J 1/16W		
R234			RK73GB1J151J	CHIP R 150 J 1/16W		
R235			RK73GB1J103J	CHIP R 10K J 1/16W		
R236			RK73GB1J100J	CHIP R 10 J 1/16W		
R237-239			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R240			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R241			RK73GB1J104J	CHIP R 100K J 1/16W		
R242			RK73GB1J392J	CHIP R 3.9K J 1/16W		
R243			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R244			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R245			RK73GB1J101J	CHIP R 100 J 1/16W		
R246			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R247			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R248			RK73GB1J274J	CHIP R 270K J 1/16W		
R249			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R250			RK73GB1J681J	CHIP R 680 J 1/16W		
R251			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R252			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R253			RK73GB1J681J	CHIP R 680 J 1/16W		
R254			RK73GB1J473J	CHIP R 47K J 1/16W		
R255			RK73GB1J103J	CHIP R 10K J 1/16W		
R256			RK73GB1J391J	CHIP R 390 J 1/16W		
R257			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R258			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R259			RK73GB1J103J	CHIP R 10K J 1/16W		
R260			RK73GB1J223J	CHIP R 22K J 1/16W		
R261			RK73GB1J101J	CHIP R 100 J 1/16W		
R262			RK73GB1J563J	CHIP R 56K J 1/16W		
R263			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R265			RK73GB1J474J	CHIP R 470K J 1/16W		
R266			RK73GB1J471J	CHIP R 470 J 1/16W		
R268,269		*	R92-1257-05	RESISTOR 0.47 1/2W		
R273			R92-1252-05	CHIP R 0 ΩHM		
R274			R92-0679-05	CHIP R 0 ΩHM		
R276			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R277			RK73GB1J221J	CHIP R 220 J 1/16W		
R278			RK73GB1J331J	CHIP R 330 J 1/16W		
R279			RK73GB1J822J	CHIP R 8.2K J 1/16W		
R280			RK73GB1J272J	CHIP R 2.7K J 1/16W		

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

⚠ indicates safety critical components.

TH-46A/AT/E

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R281			RK73GB1J331J	CHIP R 330 J 1/16W		
R282			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R283			RK73GB1J104J	CHIP R 100K J 1/16W		
R284			RK73GB1J153J	CHIP R 15K J 1/16W		
R286			R92-0679-05	CHIP R 0 ΩHM		
R287			R92-1252-05	CHIP R 0 ΩHM		
R288			R92-0679-05	CHIP R 0 ΩHM		
R289-293			R92-1252-05	CHIP R 0 ΩHM		
R295-297			R92-0679-05	CHIP R 0 ΩHM		
R298-300			R92-1252-05	CHIP R 0 ΩHM		
R301,302			R92-0679-05	CHIP R 0 ΩHM		
TH202			R92-0680-05	THERMISTΩR 7.5K		
VR201			R12-6532-05	TRIM PΩT. 470K		
VR202			R12-6527-05	TRIM PΩT. 68K		
VR203			R12-6497-05	TRIM PΩT. 10K		
VR204			R12-6495-05	TRIM PΩT. 4.7K		
VR205		*	R12-6491-05	TRIM PΩT. 1K		
D1		*	MA363	DIΩDE		
D2			MA77	DIΩDE		
D3 ,4			VA333	DIΩDE		
D5			MA110	DIΩDE		
D6			1SV172	DIΩDE		
D7			MI808	DIΩDE		
D8			DA204U	DIΩDE		
D9			1SS312	DIΩDE		
D10			MA77	DIΩDE		
D11			1SS312	DIΩDE		
D12			HSM88AS	DIΩDE		
D13		*	HVR187	DIΩDE		
D15 -17			DA204U	DIΩDE		
D18 ,19			1SS312	DIΩDE		
D21			DA204U	DIΩDE		
D201		*	EA61FC1F	DIΩDE		
D205			DAN202U	DIΩDE		
D206			02CZ8.2Y	ZENER DIΩDE		
D207			HSM88AS	DIΩDE		
D208			02CZ3.9Y	ZENER DIΩDE		
D208			02CZ3.9Z	ZENER DIΩDE		
D209			DAN202U	DIΩDE		
IC1			MB1504	IC(PLL FREQ SYNTHESIZER)		
IC2		*	TC4S11F	IC(2 INPUT NAND GATE)		
IC201			NJM4560M	IC(ΩP AMP X2)		
IC203			VB88307FP	IC(SHIFT REGISTER)		
IC204			BVM386BD	IC(AF PΩWER AMP)		
IC205		*	TK10486M	IC(FM IF)		
IC206			LM301AD	IC(ΩP AMP)		
IC207			M5236(ML)	IC(AVR)		
Q1			2SK508NV(K52)	FET		
Q2		*	2SC4226(R23)	TRANSISTΩR		
Q2		*	2SC4226(R24)	TRANSISTΩR		
Q3			2SC4117(BL)	TRANSISTΩR		
Q4 -6		*	2SC4226(R23)	TRANSISTΩR		
Q4 -6		*	2SC4226(R24)	TRANSISTΩR		
Q7			2SA1312(B)	TRANSISTΩR		

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

⚠ indicates safety critical components.

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Teile ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3520-XX)
CONTROL UNIT (W02-089X-05)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
Q8			2SC3324(B)	TRANSISTOR		
Q9		*	2SC4083	TRANSISTOR		
Q10			2SC4093	TRANSISTOR		
Q13			DTA144EU	DIGITAL TRANSISTOR		
Q14			DTC114EU	DIGITAL TRANSISTOR		
Q15			DTA114EU	DIGITAL TRANSISTOR		
Q16		*	DTB113ZK	DIGITAL TRANSISTOR		
Q17			DTC124EU	DIGITAL TRANSISTOR		
Q18			DTA114EU	DIGITAL TRANSISTOR		
Q19		*	2SC4226(R23)	TRANSISTOR		
Q19			2SC4226(R24)	TRANSISTOR		
Q20			2SC4215(Y)	TRANSISTOR		
Q21 -23		*	2SC4226(R24)	TRANSISTOR		
Q27		*	DTC124EU	DIGITAL TRANSISTOR		
Q28			DTC114EU	DIGITAL TRANSISTOR		
Q29		*	DTB113ZK	DIGITAL TRANSISTOR		
Q31			DTC114EU	DIGITAL TRANSISTOR		
Q201			2SK879(GR)	FET		
Q201		*	2SK879(Y)	FET		
Q206			FMA5	DIGITAL TRANSISTOR		
Q207			DTA114EU	DIGITAL TRANSISTOR		
Q208			2SB798(DK)	TRANSISTOR		
Q208		*	2SB798(DL)	TRANSISTOR		
Q209		*	2SC4116(BL)	TRANSISTOR		
Q209			2SC4116(GR)	TRANSISTOR		
Q210			DTC144EU	DIGITAL TRANSISTOR		
Q211,212		*	2SC4116(BL)	TRANSISTOR		
Q211,212			2SC4116(GR)	TRANSISTOR		
Q213			FMU1	DIGITAL TRANSISTOR		
Q214			2SA1586(GR)	TRANSISTOR		
Q214		*	2SA1586(Y)	TRANSISTOR		
Q215			DTC114EU	DIGITAL TRANSISTOR		
Q216			2SB798(DK)	TRANSISTOR		
Q216		*	2SB798(DL)	TRANSISTOR		
Q217		*	DTA143ZU	DIGITAL TRANSISTOR		
Q218			DTC114TU	DIGITAL TRANSISTOR		
Q219			2SB798(DK)	TRANSISTOR		
Q219		*	2SB798(DL)	TRANSISTOR		
Q220		*	DTC124TU	DIGITAL TRANSISTOR		
Q221			FMA5	DIGITAL TRANSISTOR		
Q222			DTC114EU	DIGITAL TRANSISTOR		
TH201			157-252-43001	THERMISTOR		
CONTROL UNIT (W02-089X-05)						
		*	A33-0413-08	REFLECTOR		
C1			CK73GB1E223K	CHIP C 0.022UF K		
C2 ,3			CK73GB1H471K	CHIP C 470PF K		
C4 ,5			CK73GB1E223K	CHIP C 0.022UF K		
C6 ,7			CC73GCH1H101J	CHIP C 100PF J		
C8 -16			CK73GB1H471K	CHIP C 470PF K		
C17 ,18			CK73FB1H473K	CHIP C 0.047UF K		
C19			CC73GCH1H470J	CHIP C 47F J		
C20			CK73GB1H471K	CHIP C 470PF K		
C23			CK73FB1H223K	CHIP C 0.022UF K		
C24			CC73GCH1H101J	CHIP C 100PF J		

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

⚠ indicates safety critical components.

TH-46A/AT/E

PARTS LIST

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

CONTROL UNIT (W02-089X-05)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
C25 -27			CK73GB1H471K	CHIP C 470PF K		
C28			CK73GB1E223K	CHIP C 0.022UF K		
C29			CK73GB1H222K	CHIP C 2200PF K		
C30			C92-0010-05	CHIP TAN 6.8UF 6.3WV		
C31			CK73GB1H122K	CHIP C 1200PF K		
C32			CK73GB1H471K	CHIP C 470PF K		
C33			CK73GB1E223K	CHIP C 0.022UF K		
C34			C92-0010-05	CHIP TAN 6.8UF 6.3WV		
C35			CK73GB1H471K	CHIP C 470PF K		
C36			CC73GCH1H101J	CHIP C 100PF J		
C37			CC73GCH1H470J	CHIP C 47F J		
C38			C92-0507-05	CHIP-TAN 4.7UF 6.3WV		
C39			CC73GCH1H101J	CHIP C 100PF J		
C40 -42			CC73GCH1H470J	CHIP C 47F J		
C43			CC73GCH1H101J	CHIP C 100PF J		
CN2			E29-0484-08	CONNECTOR		
CN3			E40-5344-05	CONNECTOR		
JP1			E40-5361-05	CONNECTOR		
			E31-6162-08	JUMPER PIN		
			G13-0966-08	DUMMY CONNECTOR		
			J21-4299-08	MOUNTING HARDWARE		
L1			L33-0737-05	COIL		
X1			L78-0066-05	CRYSTAL		
R1			RK73GB1J184J	CHIP R 180K J 1/16W		
R2			R92-1252-05	CHIP R 0 OHM		
R3 -7			RK73GB1J473J	CHIP R 47K J 1/16W		
R8			RK73GB1J471J	CHIP R 470 J 1/16W		
R10			RK73GB1J333J	CHIP R 33K J 1/16W		
R11			RK73GB1J183J	CHIP R 18K J 1/16W		
R12			RK73GB1J121J	CHIP R 120 J 1/16W		
R13			RK73GB1J103J	CHIP R 10K J 1/16W		
R14			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R15 -19			RK73GB1J473J	CHIP R 47K J 1/16W		
R20			RK73FB2A473J	CHIP R 47K J 1/10W		
R21 ,22			R92-0670-05	CHIP R 0 OHM		
R24 -26			R92-0670-05	CHIP R 0 OHM		
R27 ,28			RK73GB1J473J	CHIP R 47K J 1/16W		
R29			RK73GB1J183J	CHIP R 18K J 1/16W		
R30			RK73GB1J104J	CHIP R 100K J 1/16W		
R31 -34			RK73GB1J473J	CHIP R 47K J 1/16W		
R35			RK73FB2A124F	CHIP R 120K F 1/10W		
R36			RK73FB2A274F	CHIP R 270K F 1/10W		
R37			RK73GB1J473J	CHIP R 47K J 1/16W		
R39			RK73GB1J473J	CHIP R 47K J 1/16W		
R41 ,42			RK73GB1J473J	CHIP R 47K J 1/16W		
R45			RK73GB1J223J	CHIP R 22K J 1/16W		
R46			RK73GB1J564J	CHIP R 560K J 1/16W		
R48			RK73GB1J274J	CHIP R 270K J 1/16W		
R49 -53			RK73GB1J473J	CHIP R 47K J 1/16W		
R56 -58			R92-0670-05	CHIP R 0 OHM		
R59			RK73GB1J224J	CHIP R 220K J 1/16W		
R60			RK73GB1J103J	CHIP R 10K J 1/16W		
R61			RK73GB1J223J	CHIP R 22K J 1/16W		

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

⚠ indicates safety critical components.

PARTS LIST

× New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Teile ohne Parts No. werden nicht geliefert.

CONTROL UNIT (W02-089X-05)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R62			RK73GB1J224J	CHIP R 220K J 1/16W		
R63			RK73GB1J473J	CHIP R 47K J 1/16W		
R64			RK73GB1J330J	CHIP R 33 J 1/16W		
R64			R92-1252-05	CHIP R 0 ΩHM		
R65			RK73GB1J224J	CHIP R 220K J 1/16W		
R66 ,67			R92-1252-05	CHIP R 0 ΩHM		
R70			RK73GB1J101J	CHIP R 100 J 1/16W		
R70 ,71			R92-1252-05	CHIP R 0 ΩHM		
R71			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R72 -74			R92-1252-05	CHIP R 0 ΩHM		
R75 -76			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R78			RK73GB1J392J	CHIP R 3.9K J 1/16W		
R79			R92-1252-05	CHIP R 0 ΩHM		
VR1			R23-9403-05	TRIM PΩT. 50K/10K		
SW10 -12			S40-1420-05	SWITCH		
SW13			S31-1420-05	SWITCH		
SW14			S31-0406-05	SWITCH		
MIC1			T91-0381-05	MICRΩPHΩNE		
			B38-0327-08	LCD		
D1			LN01301C(Q)	LED		
D3			B30-0842-05	LED		
D4 -5			1SS272	DIΩDE		
D6			1SS309	DIΩDE		
D8			DAN202U	DIΩDE		
IC2			UPD7225GB-3B7	IC(LCD DRIVER)		
IC3			75112GF-556-3BE	IC(MPU)		
IC4			S-8054ALB-LM-T1	IC(VΩLTAGE DETECTΩR)		
IC5			R90-0711-05	RESISTΩR BLΩCK		
IC7			S-81250HG-RD-T1	IC(AVR)		
Q1			2SA1586(Y)	TRANSISTΩR		
Q2			DTC114EU	TRANSISTΩR		
Q3			DTC123JU	TRANSISTΩR		
EN1			W02-0900-05	ENCΩDER		

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

⚠ indicates safety critical components.

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 12.0V.

2. DC Ammeter
1) Class 1 ammeter (17 ranges and other features)
2) The full scale can be set to either 300mA or 3A.
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 (0.2 ppm or so).

4. Power Meter
1) Measurable frequency : Up to 500MHz
2) Impedance : 50Ω, 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 : 1MΩ or more

8. Oscilloscope
1) Measuring range : DC to 30MHz
2) Provides highly accurate measurments 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 : –20dB/0.1μV to 120dB/1V
3) Output impedance : 50Ω

12. Tracking Generator
1) Center frequency : 50kHz to 500MHz
2) Frequency deviation : ±35MHz
3) Output voltage : 100mV or more

13. Dummy Load
1) 8Ω, 3W or more

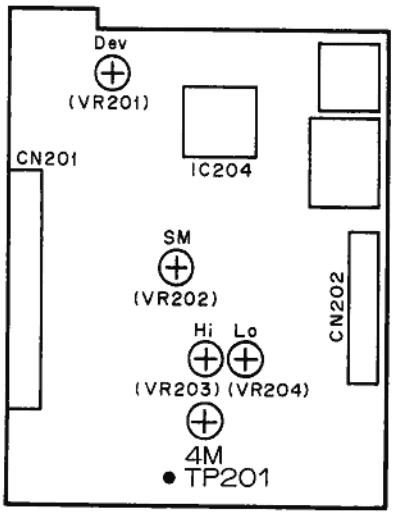
PREPARATION

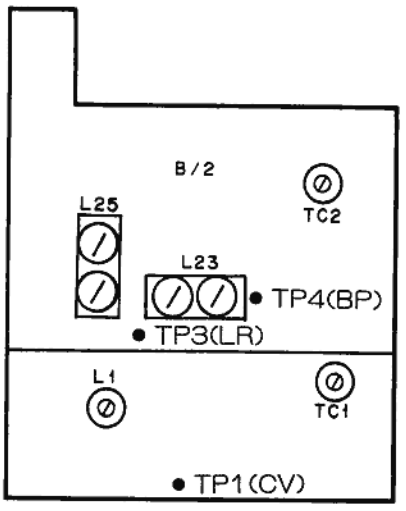
- Set the unit in the receiving mode and set the controls as follows, unless otherwise specified.

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.

ADJUSTMENT POINTS (Top View)





ADJUSTMENT

TX-RX COMMON ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test-equip.	Unit	Terminal	Unit	Parts	Method	
1. Reset	POWER SW: OFF							
	Hold down F key POWER SW: ON							
2. 4M ADJ	Power supply voltage:13.8V	DCVM	TX-RX	TP201	TX-RX	VR205	4.5V	4.45~4.55V

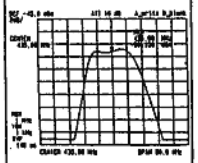
PLL ADJUSTMENT

1. Reference frequency		Frequency: 445.00MHz (K. M2) 435.00MHz (E. M. T. X) PTT: ON	F. Counter Power meter	TX-RX	ANT	TX-RX	TC1	445.00MHz (K. M2) 435.00MHz (E. M. T. X)	±600Hz
2. VCV	RX	Frequency: 445.00MHz (K. M2) 435.00MHz (E. M. T. X)	DCVM		TP1 (CV)		L2	2.7V	±0.05V
		Frequency: 440.00MHz (K. M2) 430.00MHz (E. M. T. X)						CHECK	0.9~1.1V
		Frequency: 449.98MHz (K. M2) 439.98MHz (E. M. T. X)						CHECK	3.3~3.5V
	TX	Frequency: 445.00MHz (K. M2) 435.00MHz (E. M. T. X)						CHECK	3.0~3.4V

TX ADJUSTMENT

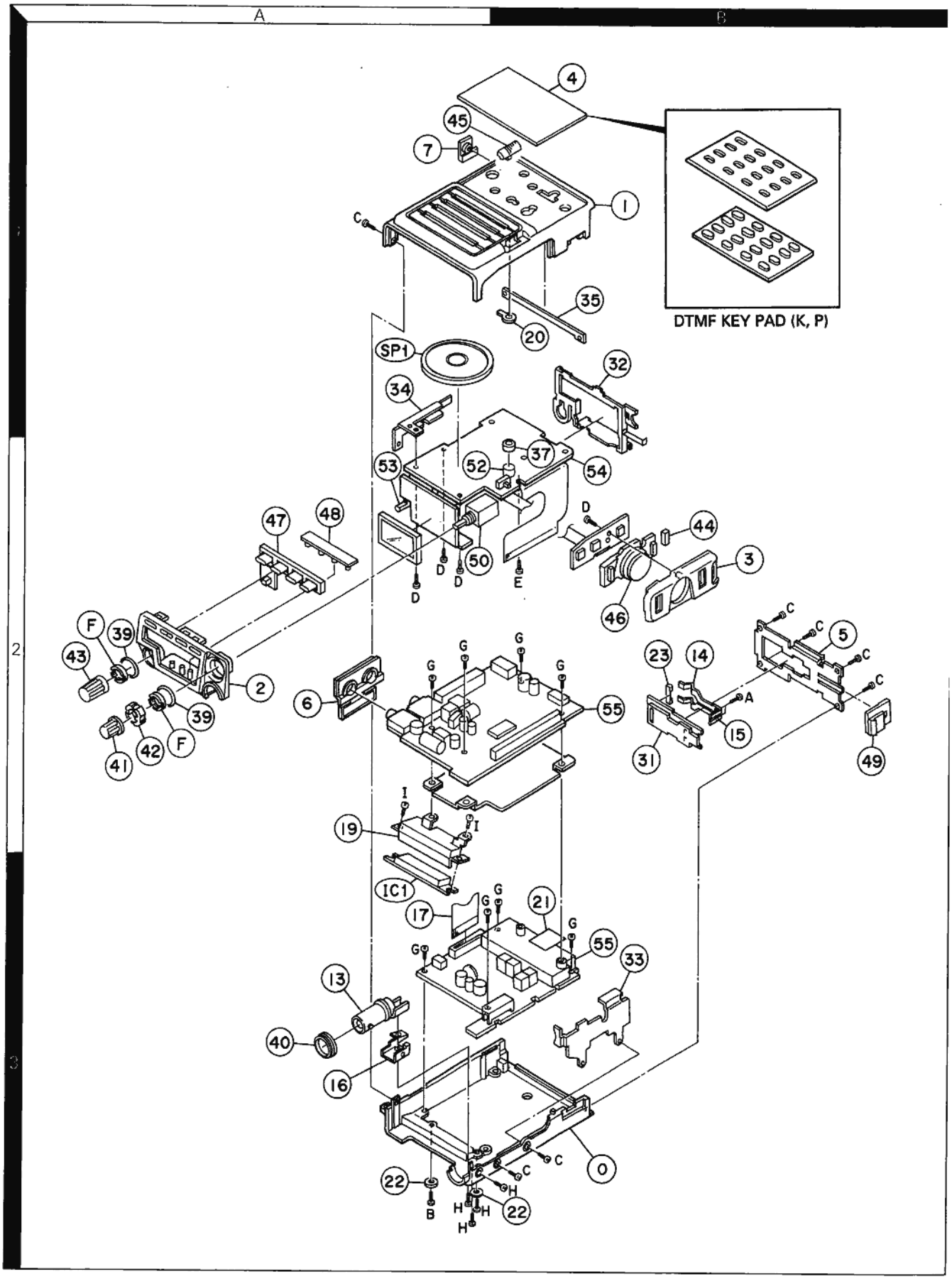
1. Power adjustment (Repeat 2~3 times)	Frequency: CENTER Power: E-LOW PTT: ON	Power meter	TX-RX	ANT	TX-RX	TC2	MAX	
	Frequency: CENTER Power: HIGH PTT: ON					VR203	5.5W	±0.5W
	Frequency: CENTER Power: LOW PTT: ON					VR204	0.5W	±0.1W
	Frequency: CENTER Power: E-LOW PTT: ON						Check	Approx. 25mW
	Frequency: CENTER Power: E-LOW DC input: 7.5V PTT: ON						Check	2W or more
2. DEV.	Frequency: CENTER AG output: 40mV, 1KHz. PTT: ON	Power meter AG Linear detector F. Counter				VR201	±4.2KHz	±200Hz
	Frequency: CENTER AG output: 4mV, 1KHz. PTT: ON						Check	±2.3~3.7KHz
3. TONE	Frequency: CENTER TONE: ON PTT: ON				CTCSS unit	VR1	0.5KHz	±0.5~1KHz
4. DTMF	Frequency: CENTER PTT: ON F and 8 key: Push				DTMF unit	VR1	±3KHz	±200Hz
5. 1750Hz TONE (E.T type only)	Frequency: CENTER 1750 key: Push						Check	±2.5~4.5KHz

RX ADJUSTMENT

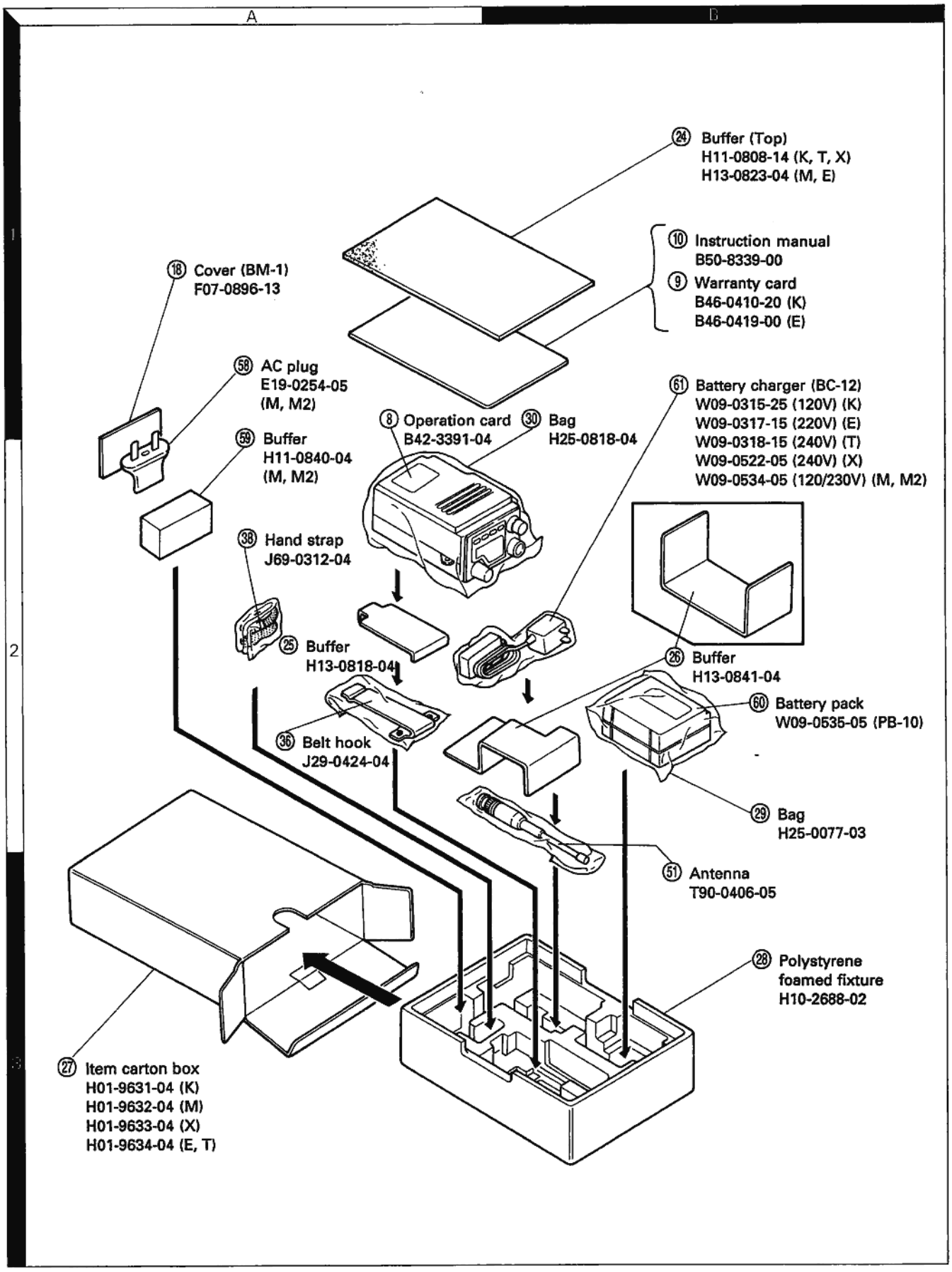
1 BPF	Frequency: CENTER Connect a sweep generator or tracking generator to ANT. Connect spectrum analyzer to the test point TP4 (BP)	Tracking generator or Sweep generator	TX-RX	ANT	TX-RX	L25, 23	The specified range should be secured with the GAIN set MAX position	
		Spectrum analyzer		TP4				
2. Reception sensitivity	Frequency: CENTER SSG output: -8dBμV MOD: 1KHz DEV: ±3KHz	Oscilloscope SSG AF V.M Distortion meter	TX-RX	SP	TX-RX		CHECK	SINAD: 12dB or more
3. S-meter	Frequency: CENTER SSG output: 10dBμV	S-meter				VR202	Adjust VR202 the 7th segment is just terned on	"——"is one pair

TH-46A/AT/E

EXPLODED VIEW



PACKING

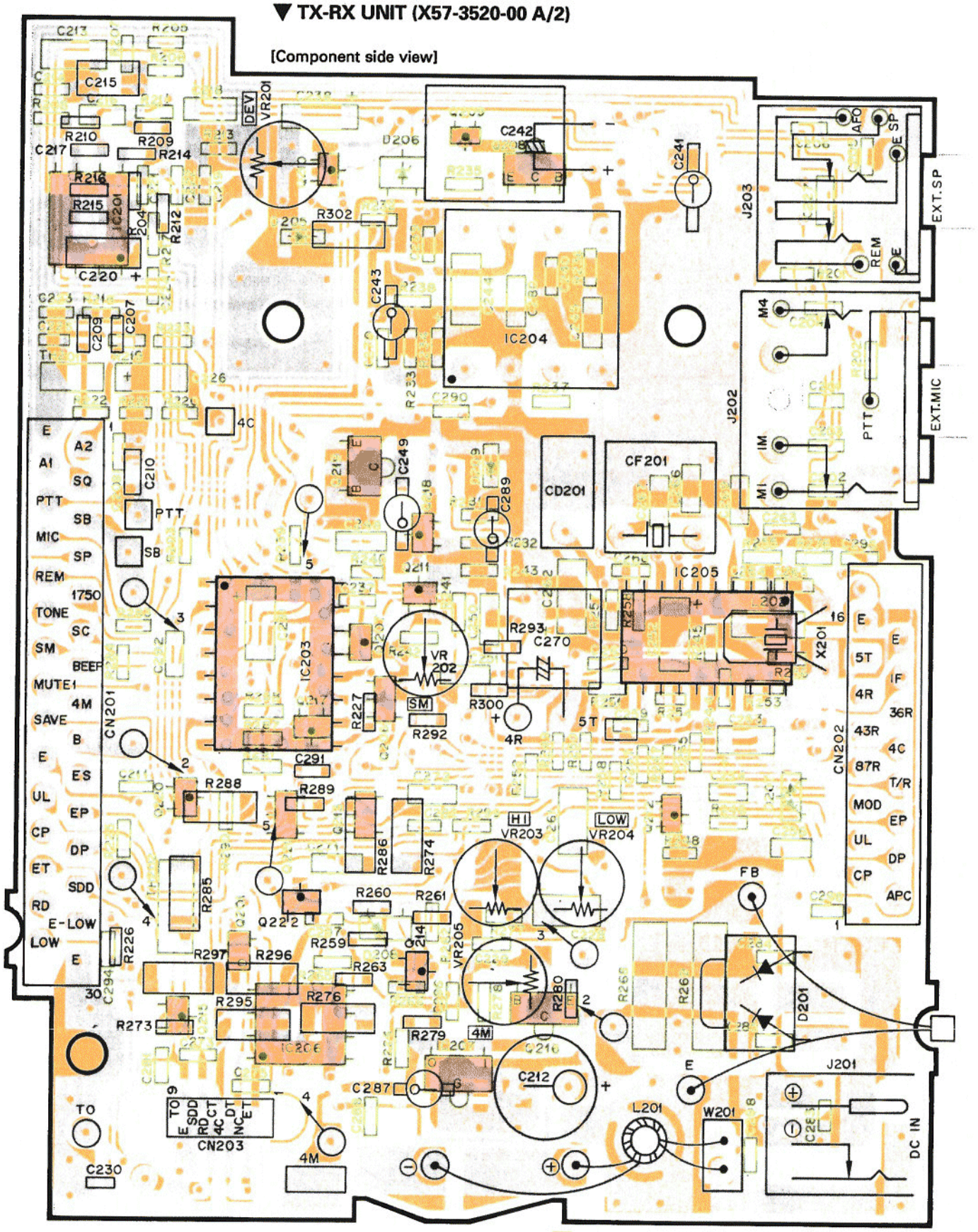

A
B
2
㉔ Buffer (Top)
H11-0808-14 (K, T, X)
H13-0823-04 (M, E)
⑩ Instruction manual
B50-8339-00
⑨ Warranty card
B46-0410-20 (K)
B46-0419-00 (E)
⑱ Cover (BM-1)
F07-0896-13
㊽ AC plug
E19-0254-05
(M, M2)
㊾ Buffer
H11-0840-04
(M, M2)
⑧ Operation card
B42-3391-04
㉚ Bag
H25-0818-04
㊶ Battery charger (BC-12)
W09-0315-25 (120V) (K)
W09-0317-15 (220V) (E)
W09-0318-15 (240V) (T)
W09-0522-05 (240V) (X)
W09-0534-05 (120/230V) (M, M2)
㊳ Hand strap
J69-0312-04
㉕ Buffer
H13-0818-04
㉖ Buffer
H13-0841-04
㊵ Belt hook
J29-0424-04
㊵ Battery pack
W09-0535-05 (PB-10)
㉙ Bag
H25-0077-03
㊶ Antenna
T90-0406-05
㉘ Polystyrene
foamed fixture
H10-2688-02
㉗ Item carton box
H01-9631-04 (K)
H01-9632-04 (M)
H01-9633-04 (X)
H01-9634-04 (E, T)

TH-46A/AT/E

PC BOARD VIEW

▼ TX-RX UNIT (X57-3520-00 A/2)

[Component side view]



: Component side pattern : Foil side pattern

IC201: NJM4560M
IC203: MB88307FP
IC204: NJM385BD
IC205: TK10488M
IC206: LM301AD
IC207: M5236 (ML)

Q201: 2SK879 (GR or Y)
Q206, 221: FMA5
Q207: DTA114EU
Q208, 216, 219: 2SB798 (DK or DL)
Q209, 211, 212: 2SC4116 (BL or GR)
Q210, 215, 222: DTC114EU

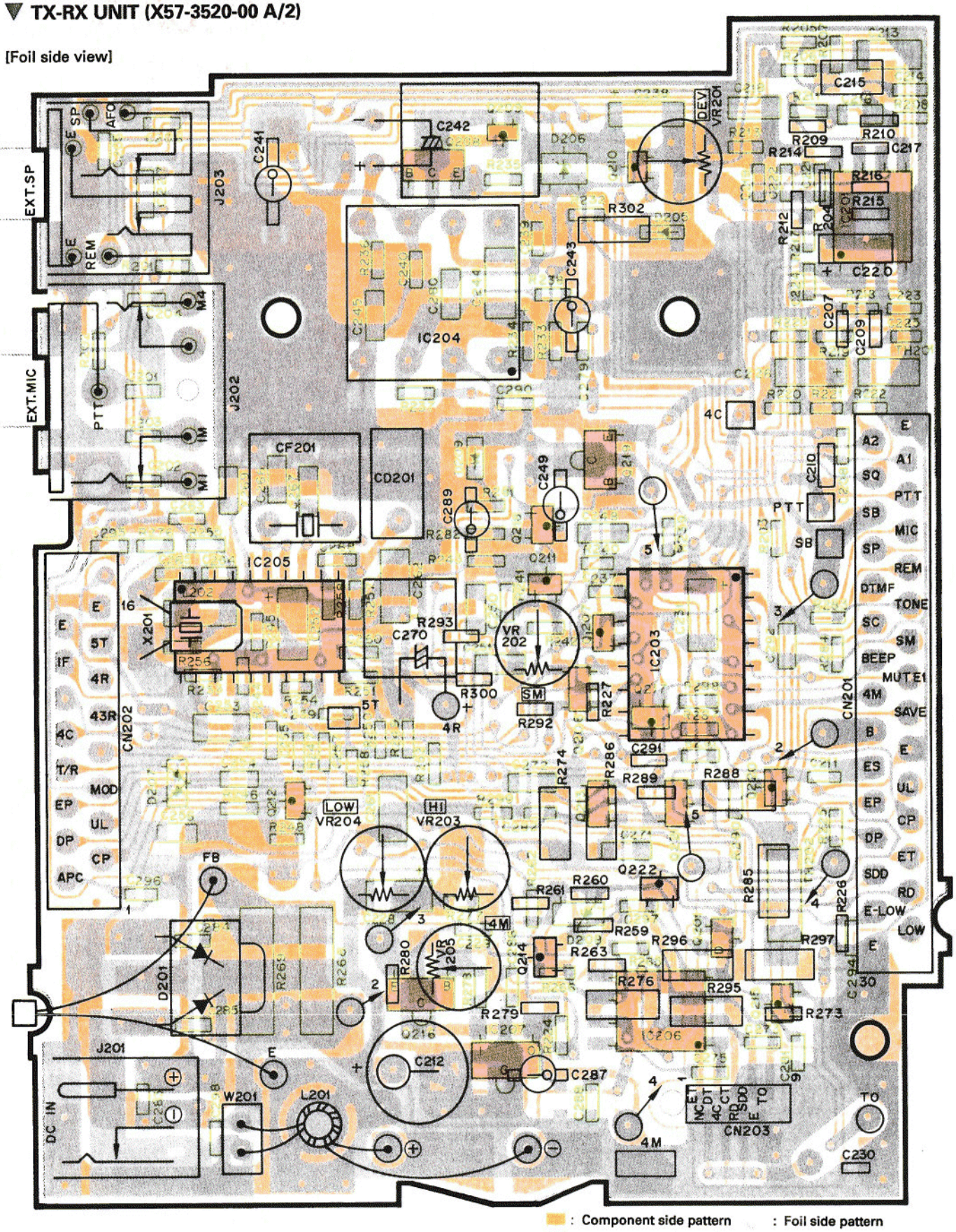
Q213: FMU1
Q214: 2SA1586 (GR or Y)
Q217: DTA143ZU
Q218: DTC114TU
Q220: DTC124TU

D201: EA61FCIF
D205, 209: DAN202U
D206: 02CZ8.2Y
D207: HSM88AS
D208: 02CZ3.9Y

PC BOARD

▼ TX-RX UNIT (X57-3520-00 A/2)

[Foil side view]



: Component side pattern : Foil side pattern

IC201: NJM4560M
IC203: MB88307FP
IC204: NJM386BD
IC205: TK10486M
IC206: LM301AD
IC207: M5236 (ML)

Q201: 2SK879 (GR or Y)
Q206, 221: FMA5
Q207: DTA*114EU
Q208, 216, 219: 2SB798 (DK or DL)
Q209, 211, 212: 2SC4116 (BL or GR)
Q210, 215, 222: DTC114EU

Q213: FMU1
Q214: 2SA1586 (GR or Y)
Q217: DTA143ZU
Q218: DTC114TU
Q220: DTC124TU

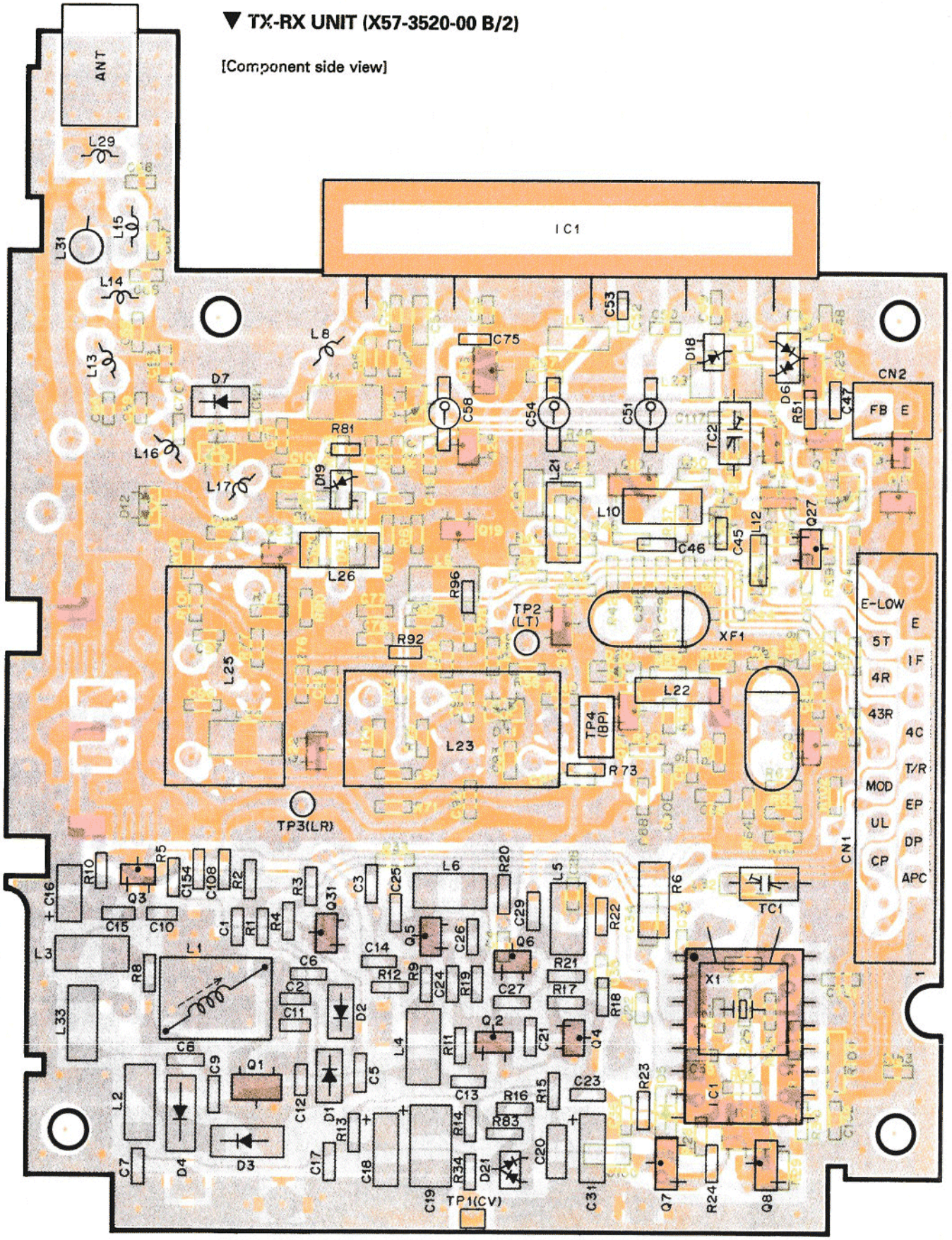
D201: EA61FCIF
D205, 209: DAN202U
D206: 02CZ8.2Y
D207: HSM88AS
D208: 02CZ3.9Y

TH-46A/AT/E

PC BOARD

▼ TX-RX UNIT (X57-3520-00 B/2)

[Component side view]



: Component side pattern : Foil side pattern

IC1: MB1504
IC2: TC4S11F
Q1: 2SK508NV (K52)
Q2, 4-6, 19, 21-26: 2SC4226 (R23 or R24)
Q3: 2SC4117 (BL)
Q7: 2SA1312 (B)

Q8: 2SC3324 (B)
Q9: 2SC4083
Q10: 2SC4093
Q13, 15, 18: DTA114EU
Q14, 28, 31: DTC114EU
Q16, 29: DTB113ZK

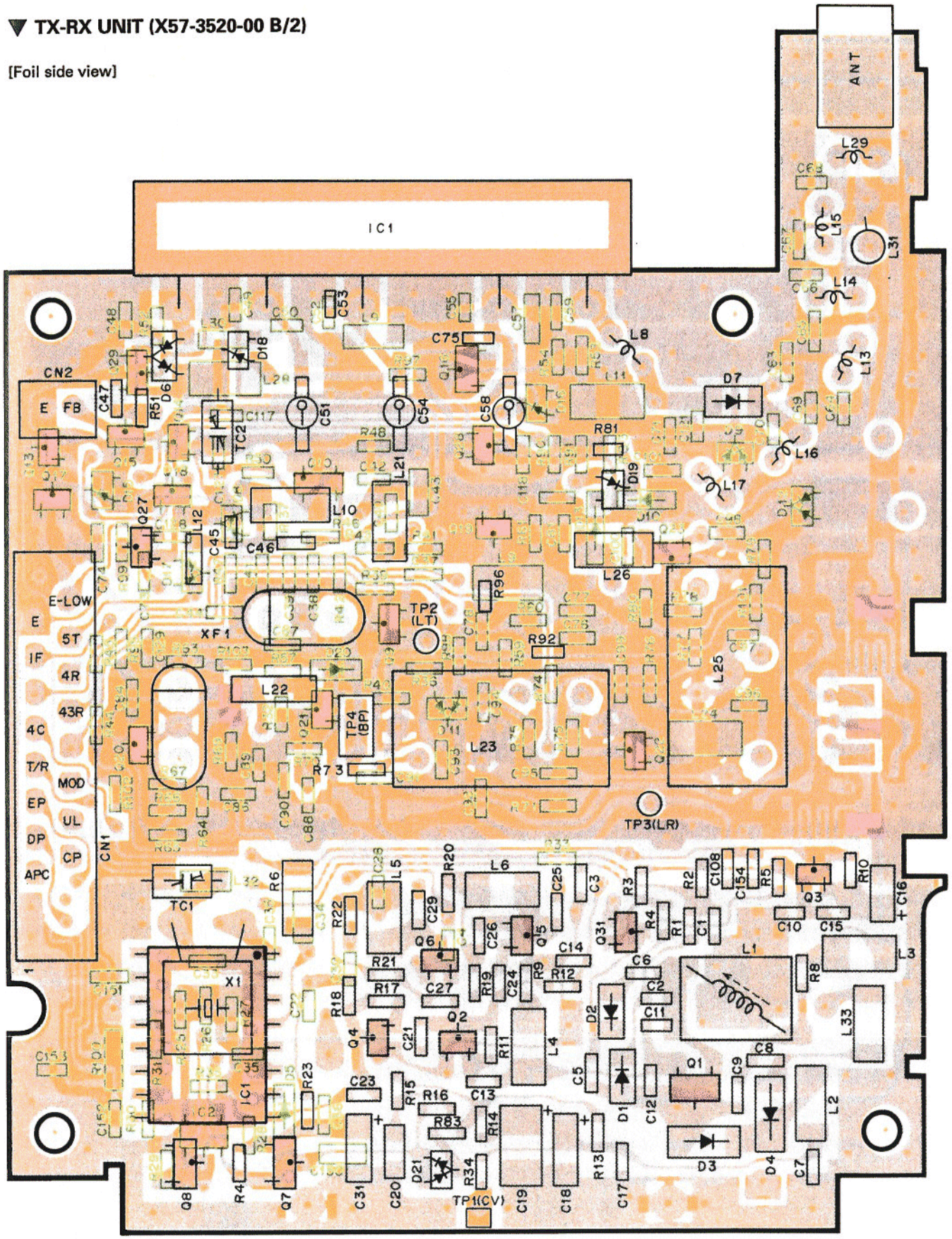
Q17, 27: DTC124EU
D1: MA363
D2, 10, 14, 20: MA77
D3, 4: MA333
D5: MA110
D6: 1SV172

D7: MI808
D8, 15-17, 21: DA204U
D9, 11, 18, 19: 1SS312
D12: HSM88AS
D13: HUR187

PC BOARD

▼ TX-RX UNIT (X57-3520-00 B/2)

[Foil side view]



: Component side pattern : Foil side pattern

IC1: MB1504
IC2: TC4S11F
Q1: 2SK508NV (K52)
Q2, 4-6, 19, 21-26: 2SC4226 (R23 or R24)
Q3: 2SC4117 (BL)
Q7: 2SA1312 (B)

Q8: 2SC3324 (B)
Q9: 2SC4083
Q10: 2SC4093
Q13, 15, 18: DTA114EU
Q14, 28, 31: DTC114EU
Q16, 29: DTB113ZK

Q17, 27: DTC124EU
D1: MA363
D2, 10, 14, 20: MA77
D3, 4: MA333
D5: MA110
D6: 1SV172

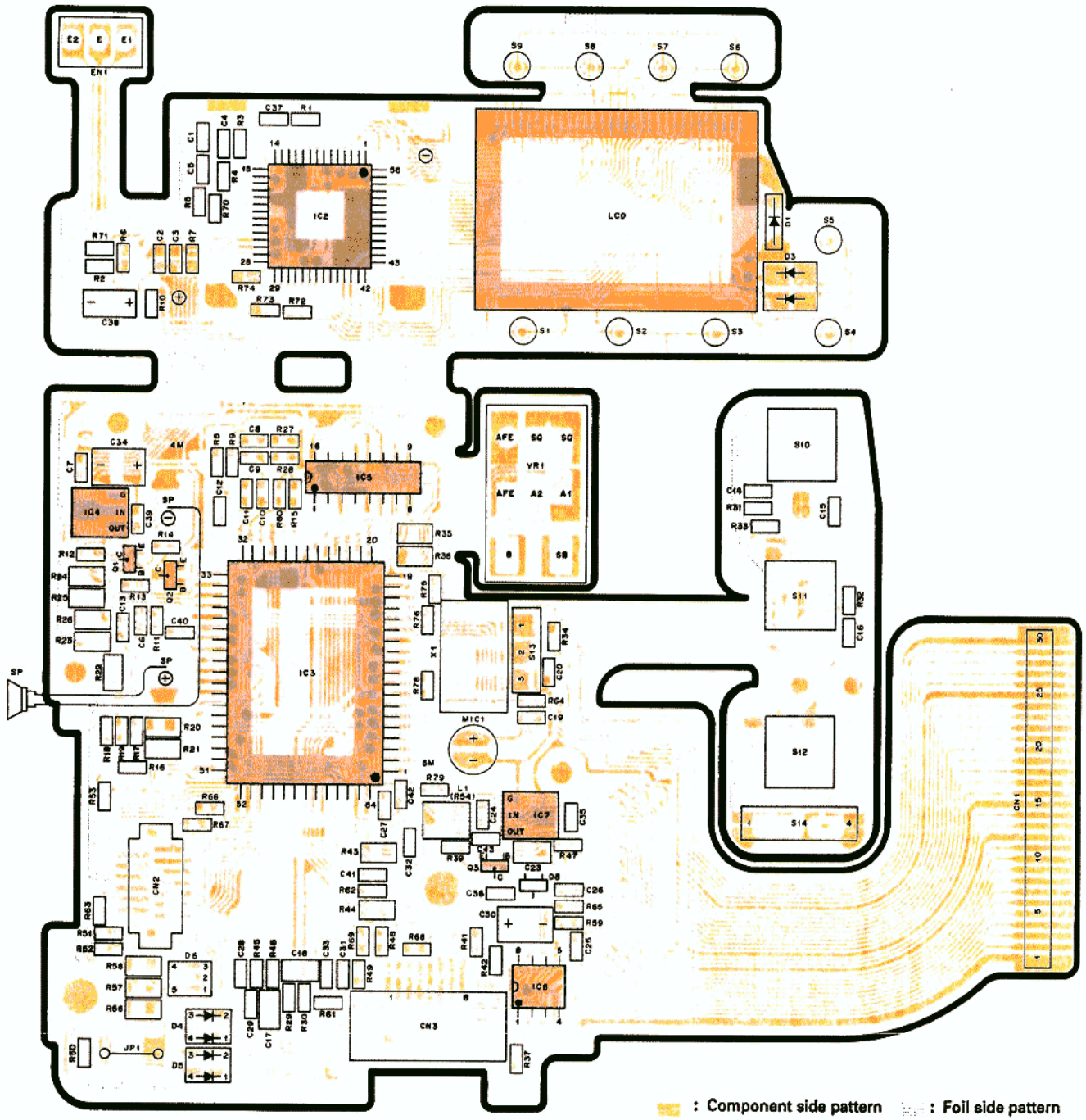
D7: MI808
D8, 15-17, 21: DA204U
D9, 11, 18, 19: 1SS312
D12: HSM88AS
D13: HUR187

TH-46A/AT/E

PC BOARD

▼ Control ASSY (WO2-XXXX-XX)

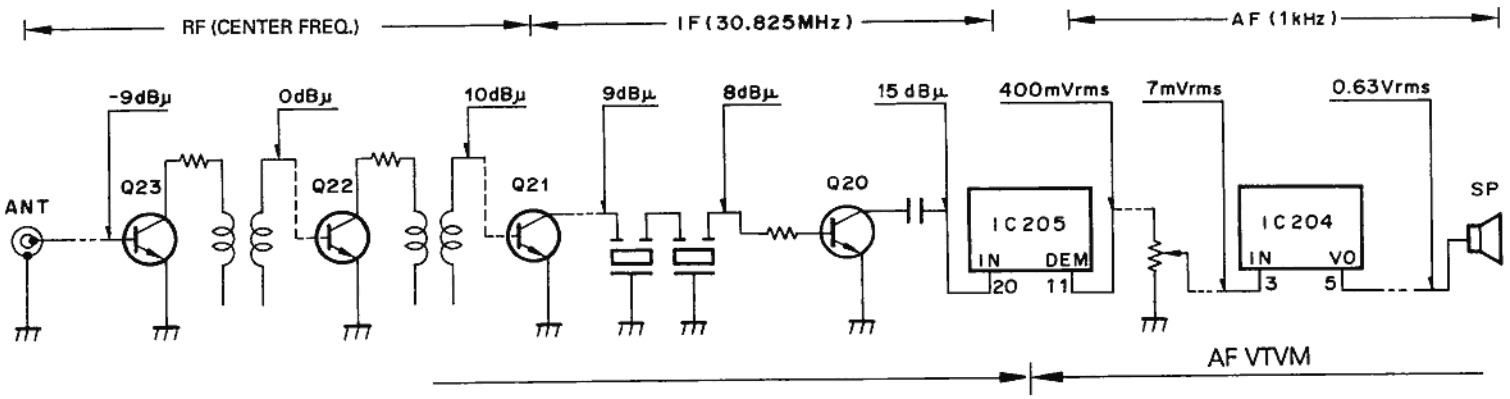
[Component side view]



: Component side pattern : Foil side pattern

IC2: UPD7225GB-3B7
IC3: 75112GD-556-3BF
IC4: S-8054ALB-LM-T1
IC7: S-81250HG-RD-T1
Q1: 2SA1586 (Y)
Q2: DTC114EU
Q3: DTC123JU
D1: LN01301C (Q)
D3: B30-0842-05
D4-5: 1SS272
D6: 1SS309
D8: DAN202U

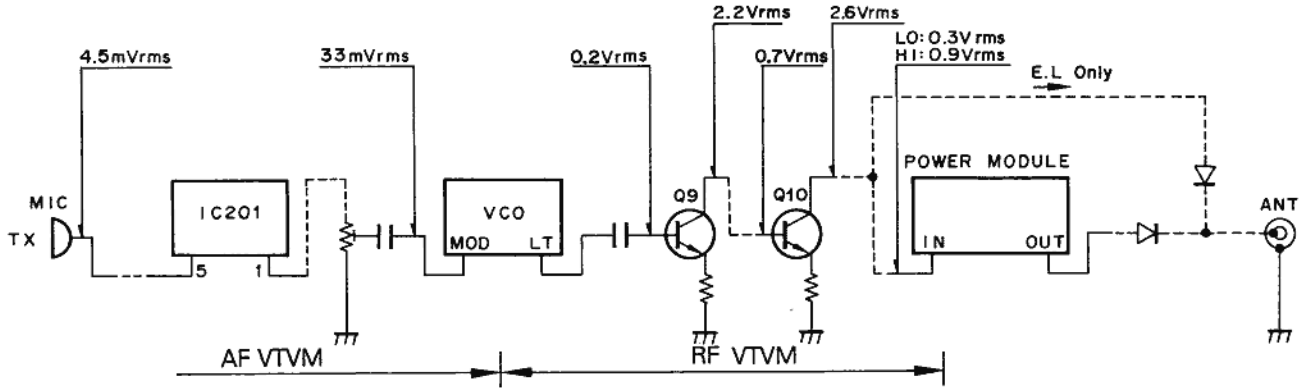
RX



Each of the levels plotted from the RF to the 1st IF is the level which can provide 12 dB SINAD for an SSG through 470 pF ceramic capacitor.

The AF level is the value measured by an AF VTVM when an SSG signal of 40 dBμ EMF modulated with a 1 kHz MOD and a 3 kHz DEV is received and the AF output is adjusted to 0.63 V/8 ohms using AFVOL.

TX



- DC INPUT: 13.8V
- 445.0 MHz (K, M2)
  435.0 MHz (E, M, X)
- Adjust AG so that the MIC jack input has a 3 kHz DEV with a 1 kHz MOD.

ANT Output
E.L : About 16dBm (Spectrum Analyzer)
LO : 0.5W (Power meter)
HI : 5W (Power meter)

TH-46A/AT/E

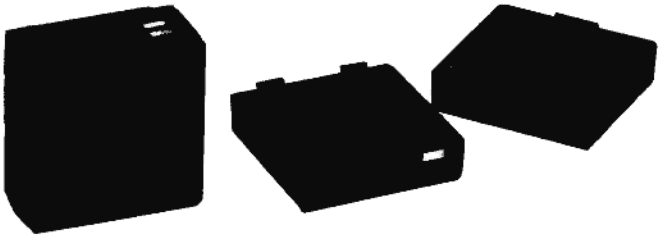
BC-9 (BATTERY CHARGER)
BT-6 (AAA MANGANESE/ALKLINE BATTERY CASE)

BC-9 EXTERNAL VIEW

BC-9 PARTS LIST

Ref. No.	New Parts	Parts No.	Description
		A02-0814-03	Case (Charge adapter)
		A40-0622-04	Bottom plate
		B42-3301-04	Label (LA) (K)
		E23-0494-04	Terminal⊖
		E23-0605-04	Terminal⊕
		G13-0852-04	Cushion
		J19-1426-03	Terminal holder

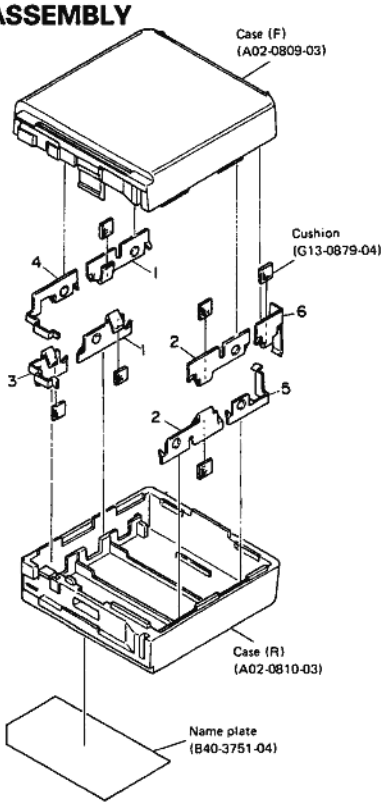
BT-6 EXTERNAL VIEW



BT-6 PARTS LIST

Ref. No.	New Parts	Parts No.	Description
1		E23-0496-04	Terminal A
2		E23-0497-04	Terminal B
3		E23-0498-04	Terminal C
4		E23-0499-04	Terminal D
5		E23-0500-04	Terminal E
6		E23-0601-04	Terminal F

BT-6 DISASSEMBLY



BC-10 (COMPACT CHARGER)

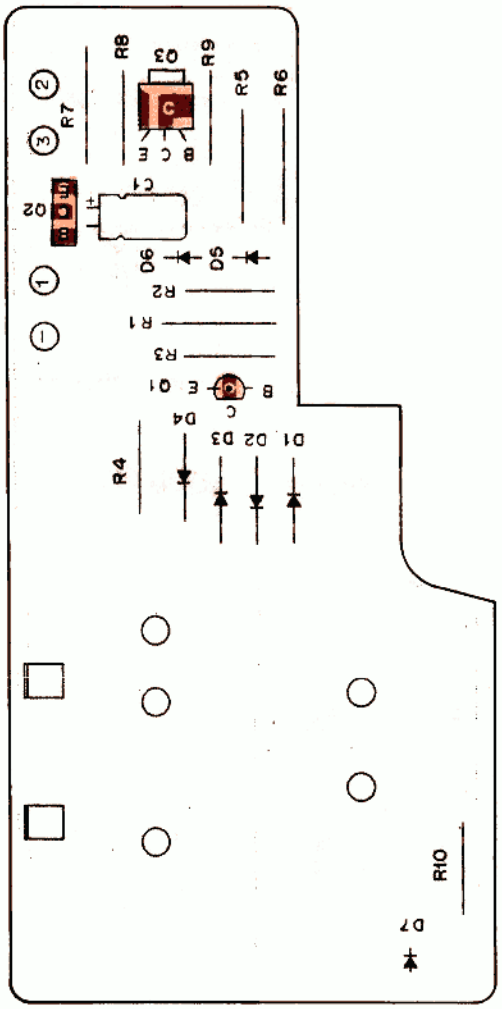
BC-10 EXTERNAL VIEW

BC-10 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		A02-0828-08	Case (Upper) **K,M,M2**
		A02-0829-08	Case (Upper) **X,T,W**
		A02-0832-08	Case (Lower)
D7		B30-0858-08	LED SR615D
		B50-8203-08	Instruction manual **K,M,M2,X,W**
		B50-8204-08	Instruction manual **T**
		E30-2097-08	AC power cord **K,M,M2**
		E30-2098-08	AC power cord **X**
		E30-2099-08	AC power cord **T**
		E30-2100-08	AC power cord **W**
		L01-8027-08	Power transformer 220V **M,W**
		L01-8111-08	Power transformer 120V **K,M2**
		L01-8152-08	Power transformer 240V **X,T**
		W02-0805-08	Module
Q1		2SA1115(E)	Transistor
Q2		2SA1241(Y)	Transistor
Q3		2SC3076	Transistor
D1–4		DSF-10TB	Diode
D5, 6		1SS133	Diode

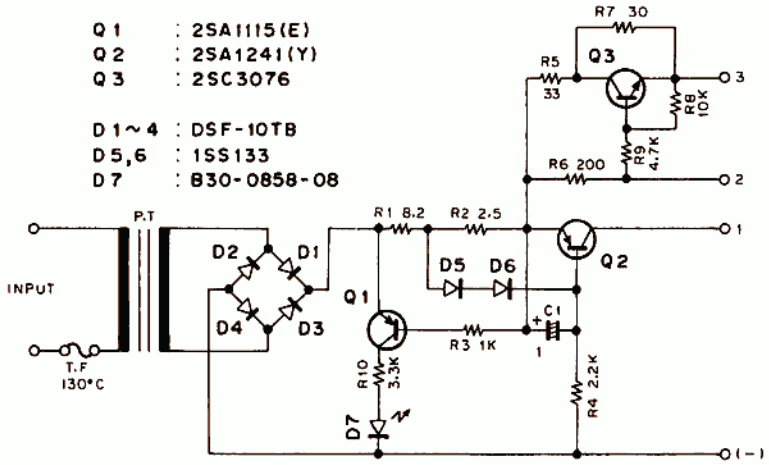
BC-10 PC BOARD VIEW



BC-10 CIRCUIT DIAGRAM

Q 1 : 2SA1115(E)
Q 2 : 2SA1241(Y)
Q 3 : 2SC3076

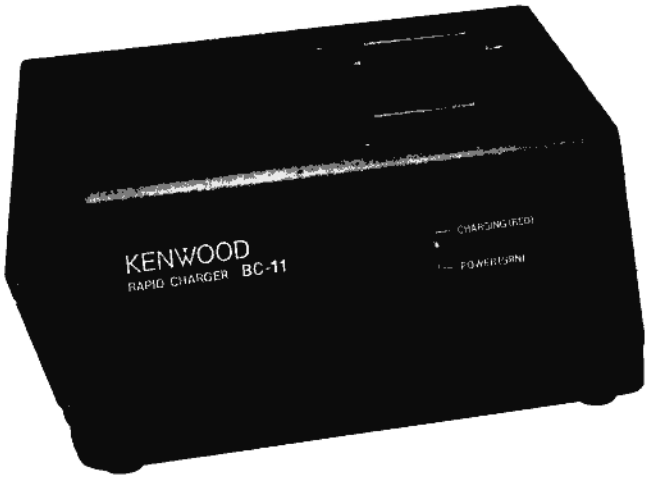
D 1 ~ 4 : DSF-10TB
D 5,6 : 1SS133
D 7 : B30-0858-08



TH-46A/AT/E

BC-11 (RAPID CHARGER)

BC-11 EXTERNAL VIEW



BC-11 CIRCUIT DESCRIPTION

General

The BC-11 is a rapid charger for the PB-5 to PB-9 and PB-11 Ni-Cd batteries for TH-26, TH-46.

Theory of Operation

The operation of each block is explained below.

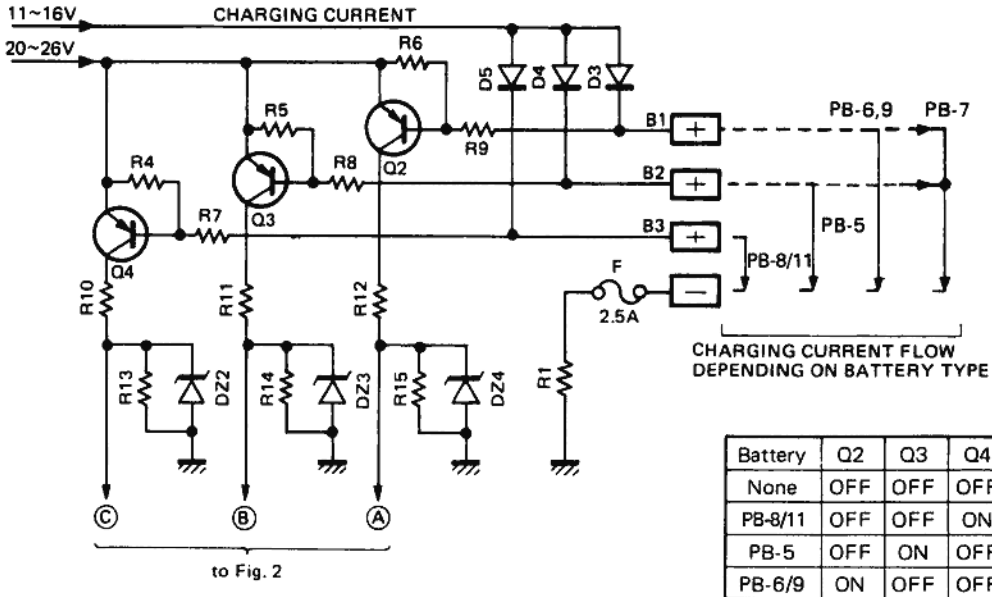
1) + 11V AVR Circuit

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.

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-6 or PB-9 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, an output of approximately 11V appears at Ⓐ in **Figure 1**. Similary when a PB-5/7 is inserted Q3 : 2SA608E turns on and approximately 11V is provided at output Ⓑ. When a PB-8/11 is inserted Q4 : 2SA608E turns on and approximately 11V is provided at output Ⓒ.



Battery	Q2	Q3	Q4
None	OFF	OFF	OFF
PB-8/11	OFF	OFF	ON
PB-5	OFF	ON	OFF
PB-6/9	ON	OFF	OFF
PB-7	ON	ON	OFF

Table 1

Fig. 1 Battery Pack Detect Circuit Block Diagram

BC-11 (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

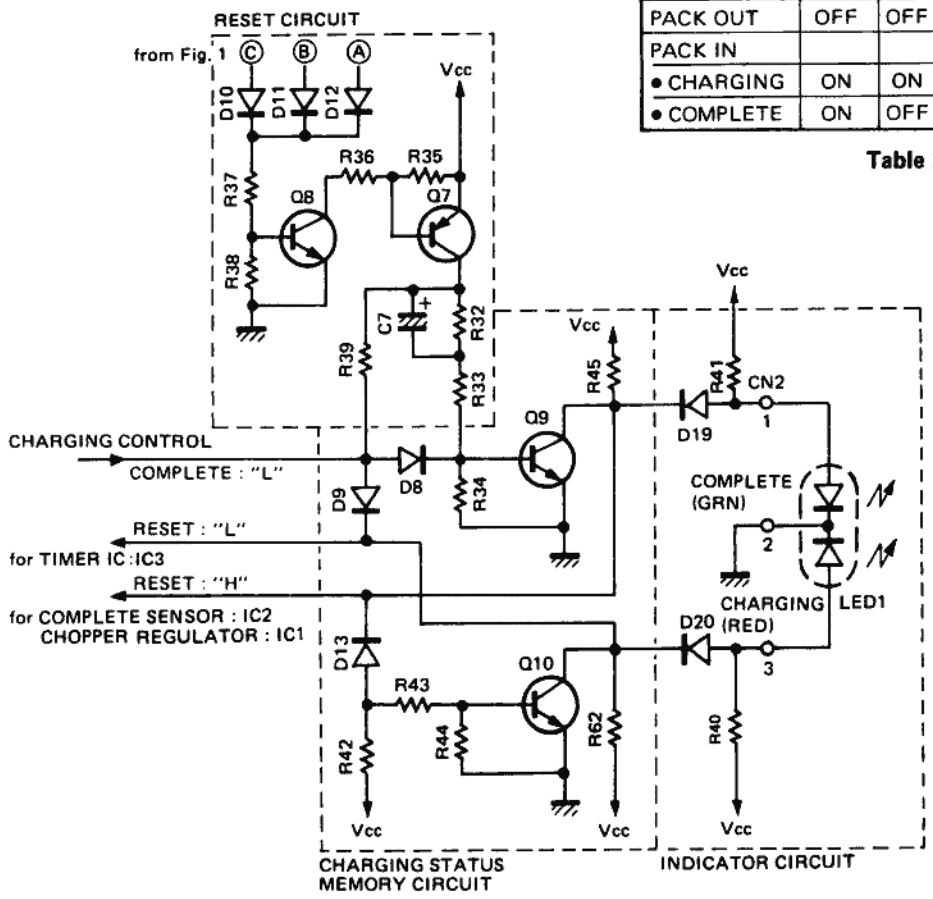


Fig. 2 Reset Circuit/Charge Status Memory Circuit/Display Circuit Block Diagram

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-11 (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		
	A	B	D	F	G
PB-5	L	H	H	H	L
PB-6	H	L	H	L	H
PB-7	H	H	L	L	H
PB-8/11	L	L	H	L	L
PB-9	H	L	H	L	H

Table 3

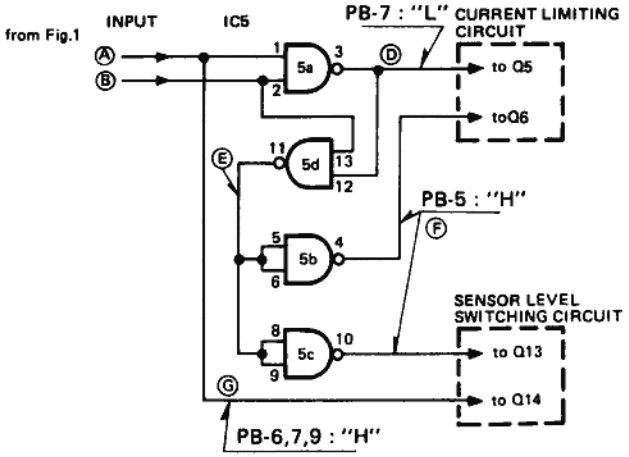


Fig. 3 Battery Recognition Circuit Block Diagram

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 (V_{REF}) used as a comparison standard for limiting the charging current. The V_{REF} 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 :

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

	Q5	Q6	VREF	ICR MAX
PB-5	OFF	ON	0.15V	1.0A
PB-6	OFF	OFF	0.25V	1.7A
PB-7	ON	OFF	0.36V	2.4A
PB-8/11	OFF	OFF	0.25V	1.7A
PB-9	OFF	OFF	0.25V	1.7A

Table 4

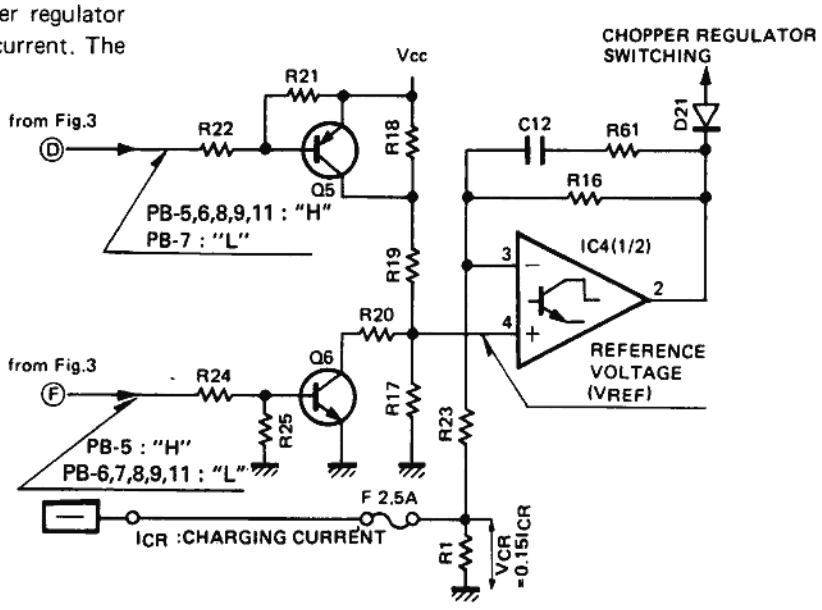


Fig. 4 Charging Current Limiting Circuit Block Diagram

BC-11 (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.

	SHIFT Es(V)	Q11	Q12
PB-5	2.0	ON	OFF
PB-6	2.0	OFF	ON
PB-7	2.0	OFF	ON
PB-8/11	7.6	OFF	OFF
PB-9	2.0	OFF	ON

Table 5

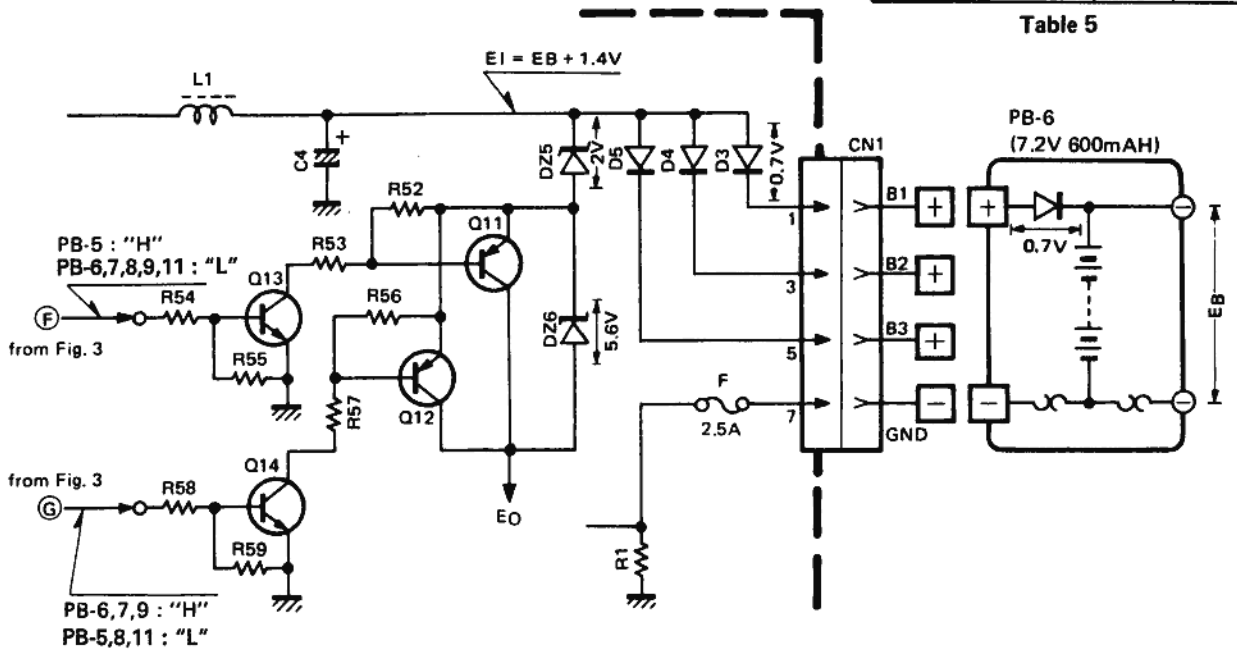


Fig. 5 Sensor Level Switching Circuit Block Diagram

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-8
Approximately 8.6V for the PB-5,6,7,9,11

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

EI = EB + 1.4V . . . . . (1)

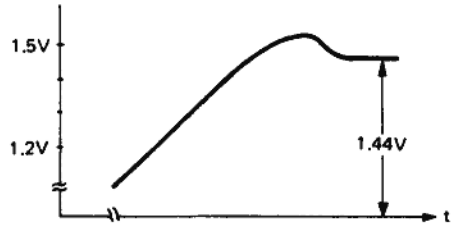


Fig. 6 The pin voltages while the Ni-CD Battery is charging

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 substitued into EO in **Table 5**, the results are:

PB-8,11 : EO = EB – 6.2V
PB-5,6,7,9 : EO = EB – 0.6V

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

BC-11 (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 ΔV 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.

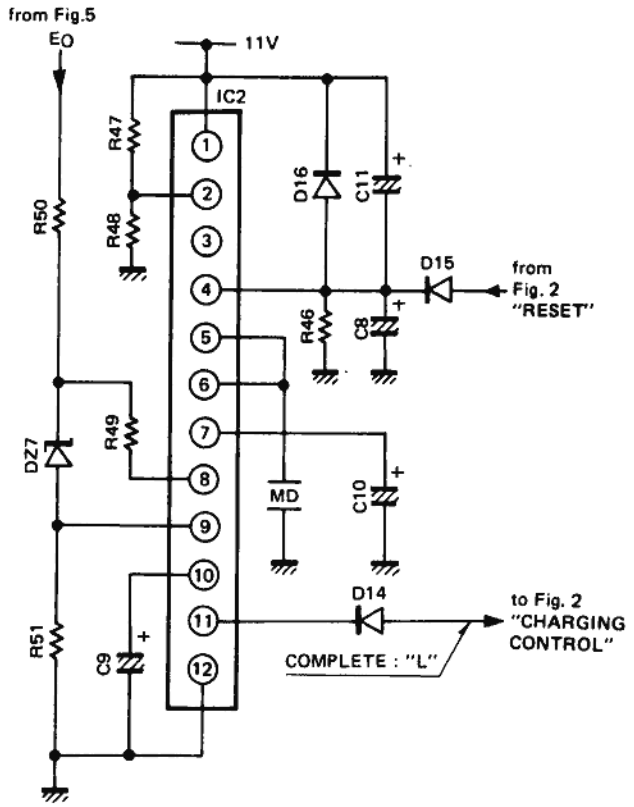


Fig. 7 Charging Status Detect Circuit Block Diagram

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).

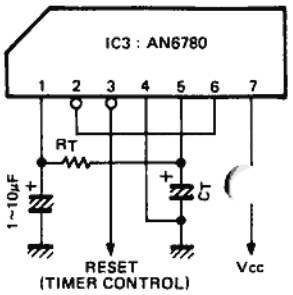


Fig. 8 Timer Circuit Block Diagram

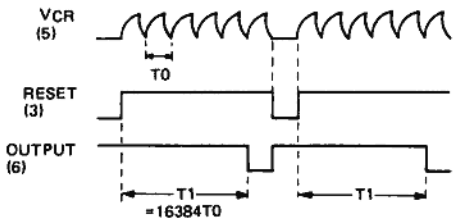


Fig. 9 TIMER TIME T1(s)≅11RT(KΩ)·CT(μF)
TIMER TIME T1(s)≅11×47(KΩ)·10(μF)=5170(s)

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.

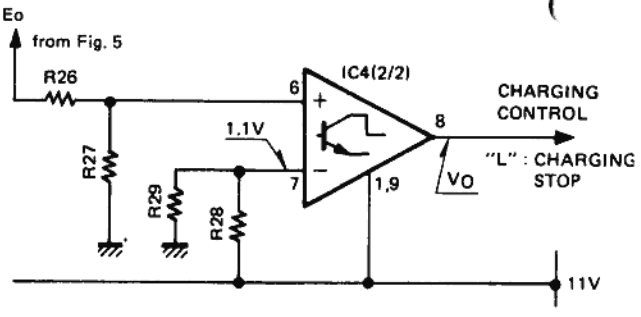


Fig. 10 Voltage Comparator Circuit Block Diagram

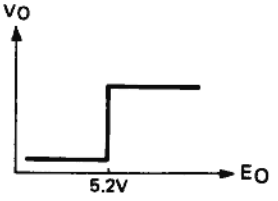


Fig. 11

BC-11 (RAPID CHARGER)

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

BC-11 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	Destination 仕向	Remarks 備考
			BC-11			
1	1A		A02-0815-08	CASE		
2	1A,1B		A02-0817-08	BATTERY POCKET		
3	1B		B46-0411-00	WARRANTY CARD	K	
4	1B		B50-8134-08	INSTRUCTION MANUAL		
5	1B		E23-0604-05	TERMINAL		
⚠ 6	2A		E30-2038-08	AC CORD	K,M,M2	
⚠ 6	2A		E30-2072-08	AC CORD	W	
⚠ 6	2A		E30-2073-08	AC CORD	T	
⚠ 6	2A		E30-2095-08	AC CORD	X	
8	2B		H01-8128-08	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		
⚠ T1	2A		L01-8081-08	POWER TRANSFORMER (AC120V)	K,M2	
⚠ T1	2A		L01-8112-08	POWER TRANSFORMER (AC220V)	M,W	
⚠ T1	2A		L01-8122-08	POWER TRANSFORMER (AC240V)	T,X	
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		W02-0399-08	CHARGE CONTROL UNIT		
			CHARGE CONTROL UNIT (W02-0399-08)			
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 W:Europe
A: Saudi Arabia T: England U: PX(Far East, Hawaii)
UE: AAFES(Europe) X: Australia M: Other Areas

⚠ indicates safety critical components.

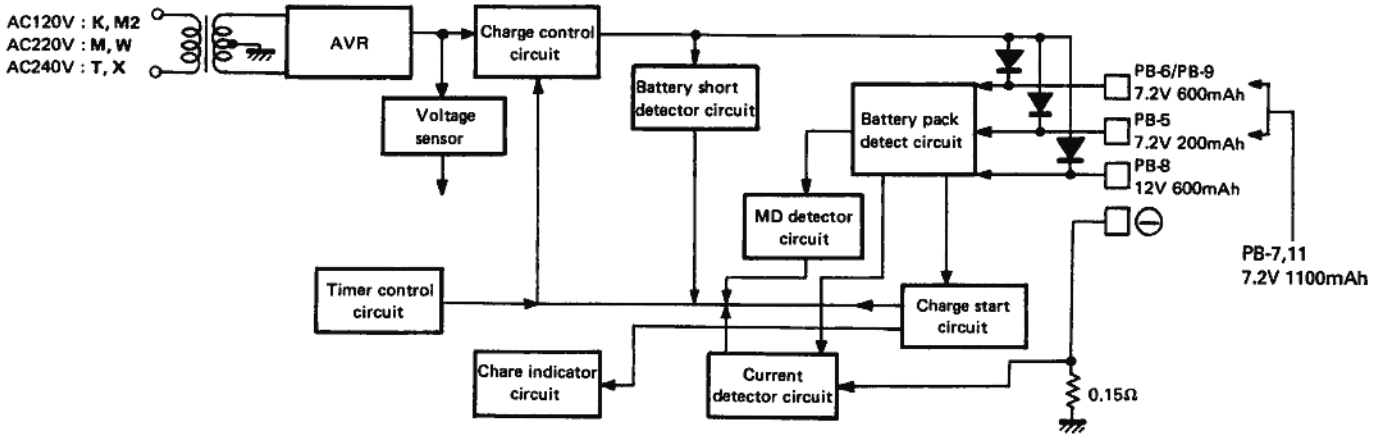
TH-46A/AT/E

BC-11 (RAPID CHARGER)

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Teile ohne Parts No. werden nicht geliefert.

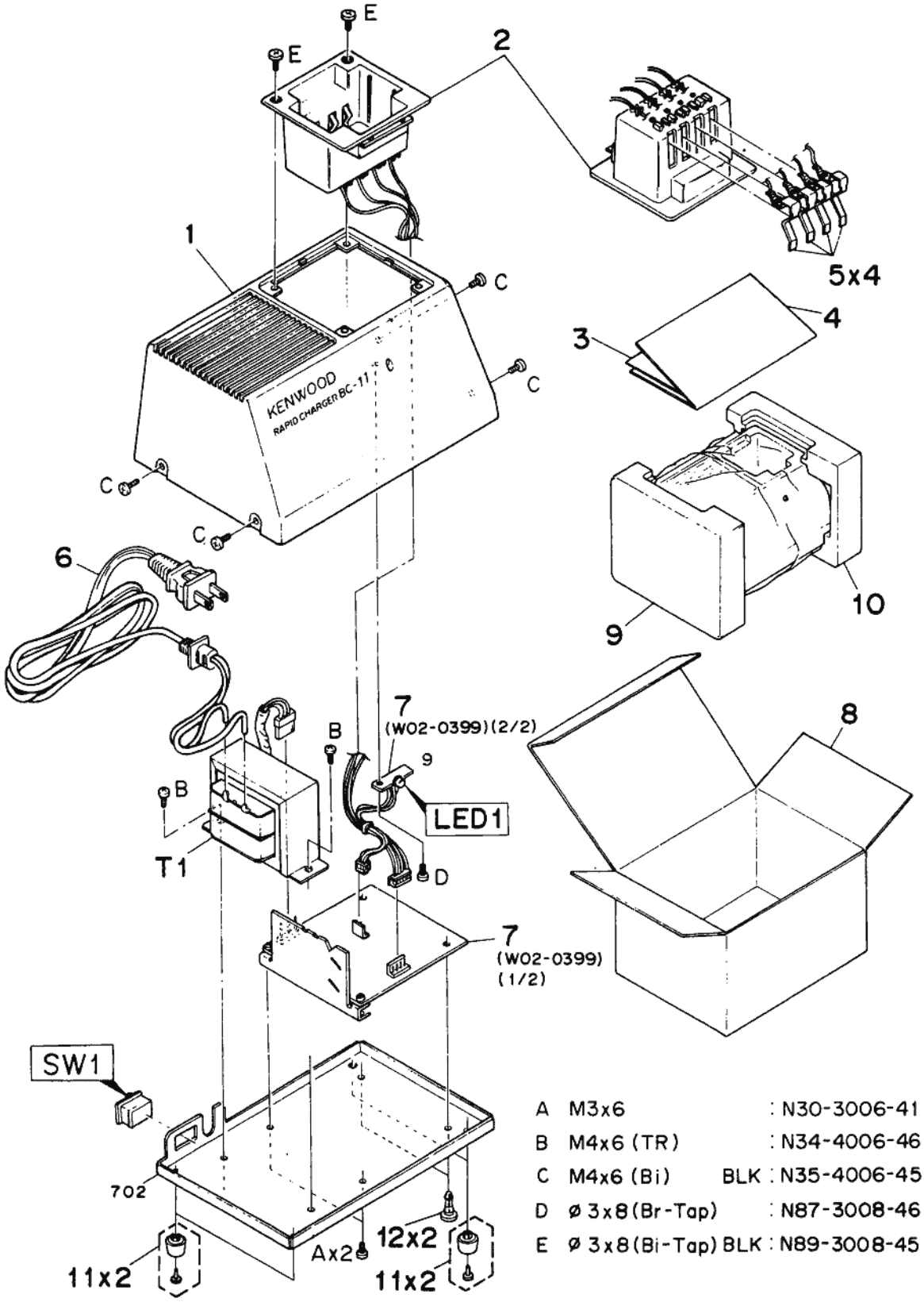
Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
MD			C91-1038-08	ELECTRO		
⚠ F1			F05-2525-05	FUSE (2.5A)	W,X	
⚠ F1			F06-2522-05	FUSE (2.5A)	M,M2,T	
⚠ F1			F06-2523-05	FUSE (2.5A)	K	
–			J13-0039-05	FUSE HOLDER	W	
L1			L33-0694-08	CHOKE COIL (470μH)		
R1			R92-0683-08	FL-PROOF 0.15Ω 4W		
D1–5			DSA26B	DIODE		
D6–16			DS442	DIODE		
D19–21			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)		

BC-11 BLOCK DIAGRAM



BC-11 (RAPID CHARGER)

BC-11 DISASSEMBLY/PACKING



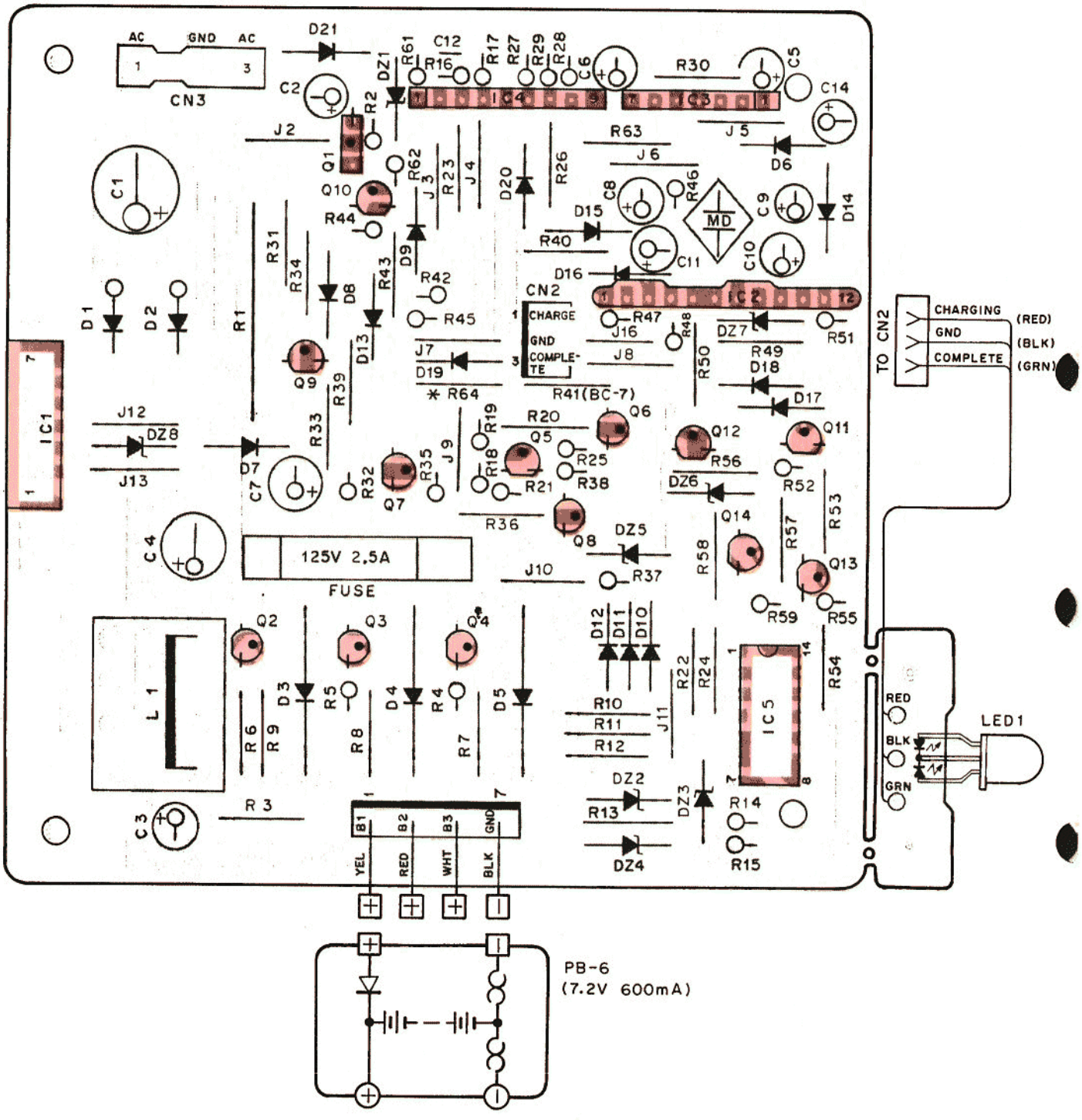
A	M3x6		: N30-3006-41
B	M4x6 (TR)		: N34-4006-46
C	M4x6 (Bi)	BLK	: N35-4006-45
D	ø 3x8 (Br-Tap)		: N87-3008-46
E	ø 3x8 (Bi-Tap)	BLK	: N89-3008-45

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

TH-46A/AT/E

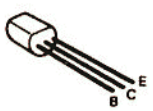
BC-11 (RAPID CHARGER)

BC-11 PC BOARD VIEW

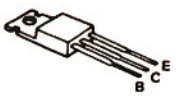


Q1 : 2SD600F,KF Q2–5,7,11,12 : 2SA608E,F Q6,8–10,13,14 : 2SC536E,F
IC1 : STK772B IC2 : KCH-1003 IC3 : AN6780 IC4 : LA6393S IC5 : LC4011B
D1–5 : DSA26B D6–16,19–21 : DS442
DZ1 : GZA11Y DZ2–4 : GZA10Z DZ5 : GZA2.0X DZ6 : GZA5.6X DZ7 : GZA7.5Y DZ8 : GZA3.0X

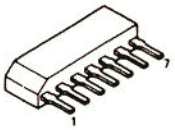
2SA608E
2SA608F



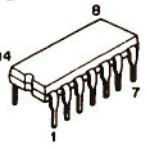
2SC536E 2SD600F
2SC536F 2SD600KF



AN6780



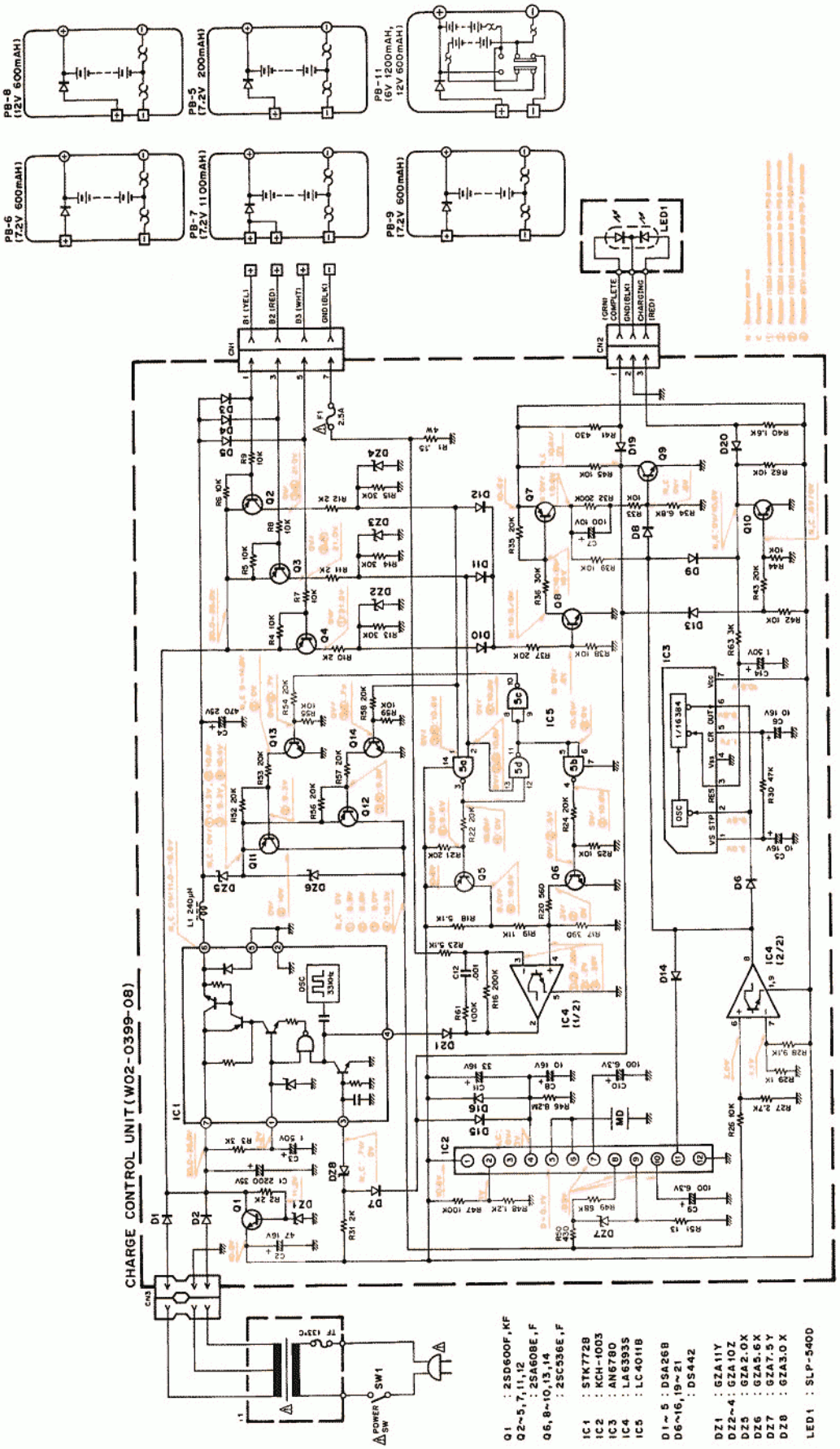
LC4011B



LA6393S

BC-11 (RAPID CHARGER)

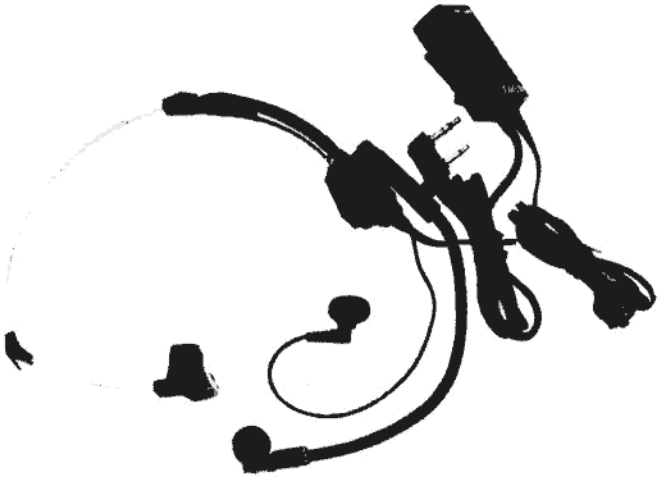
BC-11 CIRCUIT DIAGRAM



TH-46A/AT/E

HMC-2 (HEAD SET WITH VOX & PTT)

HMC-2 EXTERNAL VIEW



HMC-2 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		A02-0840-08	Case (Front)
		A02-0841-08	Case (Rear)
		E30-2088-08	Cable with plug
		F09-0418-08	Microphone pad
		F09-0419-08	Ear pad
		J29-0427-08	Clip
VR1		R05-4422-08	Potentiometer 50kΩ
S1		S31-1416-08	Slide switch PTT/VOX
S2		S50-1413-05	Tact switch PTT
		T18-0056-08	Earphone with cable
		T91-0373-18	MIC ass'y
		W02-0806-18	VOX/PTT unit
Q1		FMG2	Digital transistor
Q2		FMW2	Digital transistor
Q3		2SC2712(GR)	Chip transistor
IC1		NJM2072M	IC
D1		1SS133	Diode

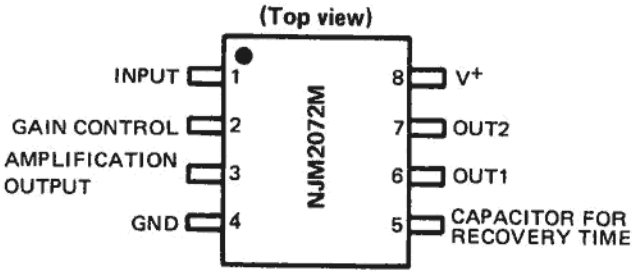
HMC-2 SPECIFICATIONS

Electrical characteristic

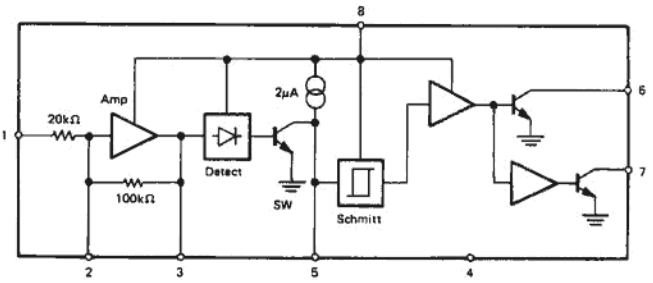
- **Earphone**
  - Diameter ϕ19
  - Impedance 19Ω (1000Hz)
  - Max. input power 50mW
- **Microphone**
  - Output sensitivity . . −67.5dB (0dB = 1V/μbar 1000Hz)
  - Output impedance 1.6kΩ (1000Hz)

HMC-2 SEMICONDUCTOR DATA

- **Terminal connection diagram**



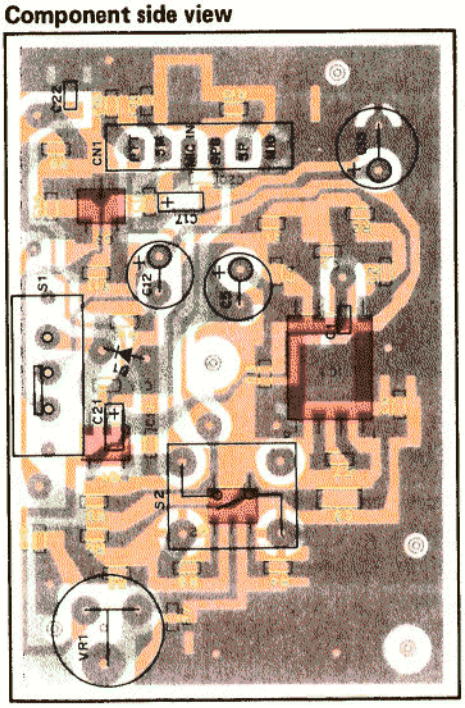
- **Block diagram**



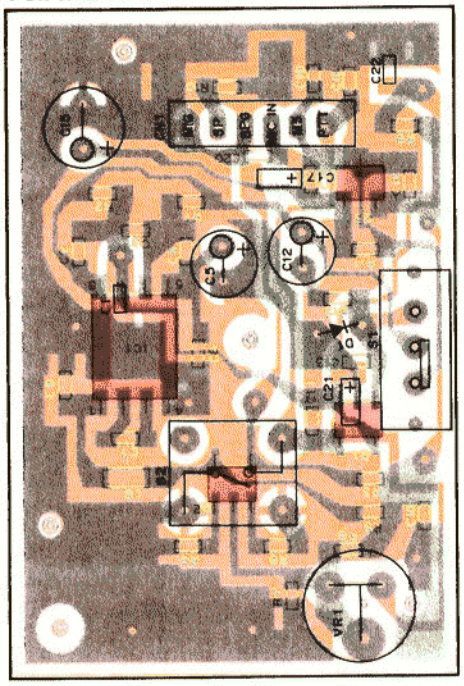
HMC-2 (HEAD SET WITH VOX & PTT)

HMC-2 PC BOARD VIEWS

Component side view



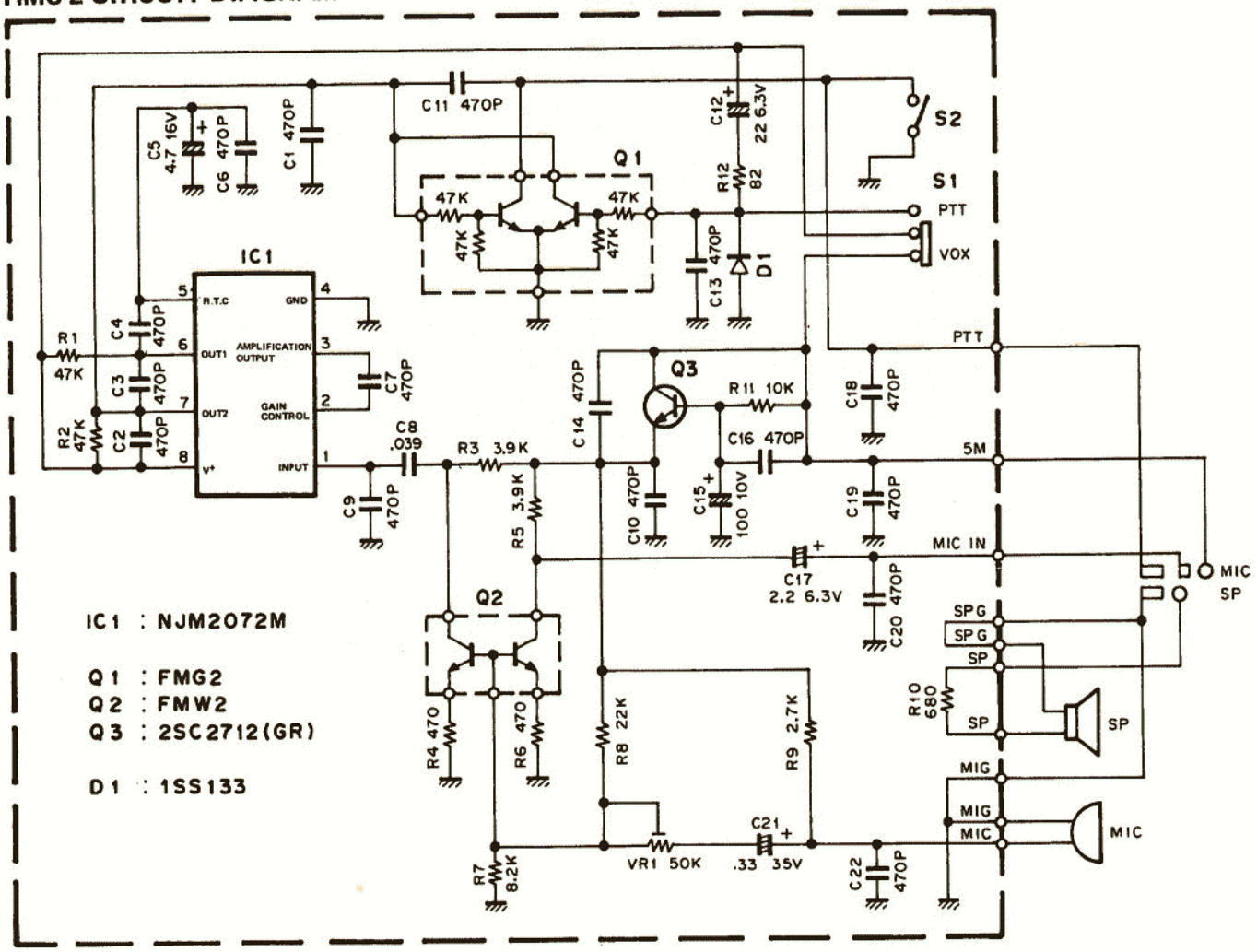
Foil side view



: Component side

: Foil side

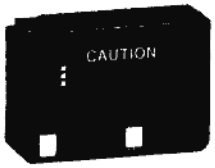
HMC-2 CIRCUIT DIAGRAM



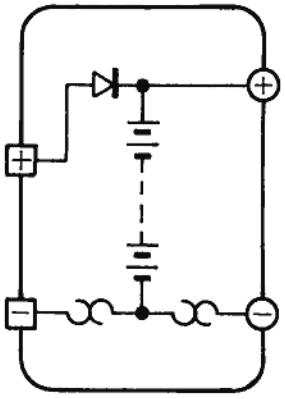
TH-46A/AT/E

PB-5/6/7/8/9/10/11 (Ni-Cd BATTERY)

PB-5 EXTERNAL VIEW

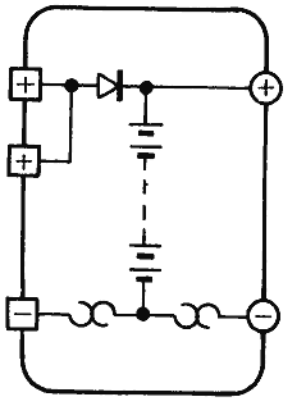


PB-5 CIRCUIT DIAGRAM



PB-7 EXTERNAL VIEW

PB-7 CIRCUIT DIAGRAM



PB-5 SPECIFICATIONS

Electrical characteristic

Voltage	7.2V (1.2V x 6)
Charging current	200mAh
Dimensions	58 W x 36.5 (39.5) H x 29.5 D (mm)
Weight	80g

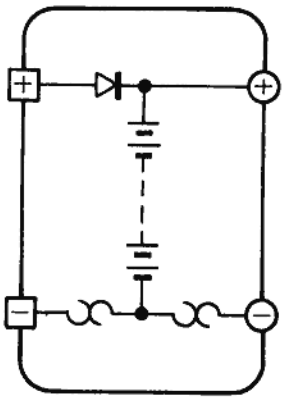
PB-7 SPECIFICATIONS

Electrical characteristic

Voltage	7.2V (1.2V x 6)
Charging current	1100mAh
Dimensions	58 W x 98.5 (101.5) H x 29.5 D (mm)
Weight	300g

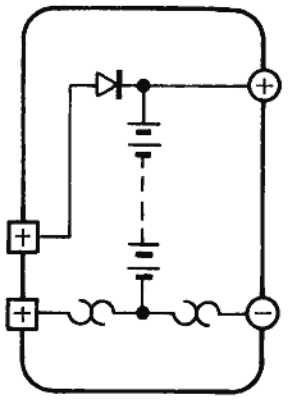
PB-6 EXTERNAL VIEW

PB-6 CIRCUIT DIAGRAM



PB-8 EXTERNAL VIEW

PB-8 CIRCUIT DIAGRAM



PB-6 SPECIFICATIONS

Electrical characteristic

Voltage	7.2V (1.2V x 6)
Charging current	600mAh
Dimensions	58 H x 55.5 (58.5) H x 29.5 D (mm)
Weight	180g

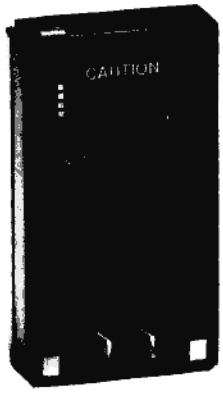
PB-8 SPECIFICATIONS

Electrical characteristic

Voltage	12V (1.2V x 10)
Charging current	600mAh
Dimensions	58 W x 84 (87) H x 29.5 D (mm)
Weight	270g

PB-5/6/7/8/9/10/11 (Ni-Cd BATTERY)

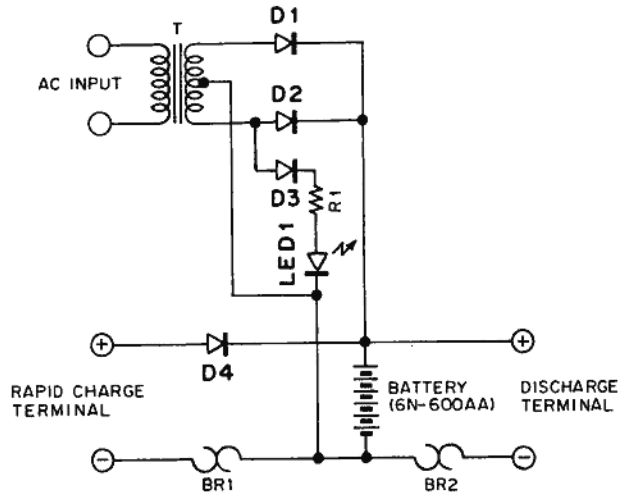
PB-9 EXTERNAL VIEW



PB-10 EXTERNAL VIEW

PB-11 EXTERNAL VIEW

PB-9 SCHEMATIC DIAGRAM



PB-9 SPECIFICATIONS

Electrical characteristic

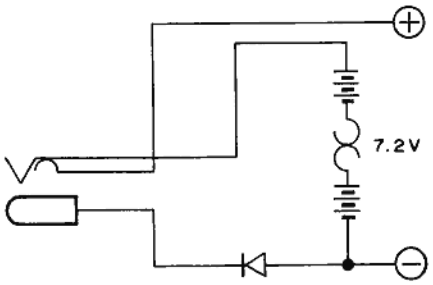
Voltage	7.2V (1.2V x 6)
Charging current	600mAh
Charging input	AC 100 to 120V, 50/60Hz, 2.2W
Charging output	DC 8.0V, 100mA
Charging time	Approx. 10 hours
Dimensions	58 W x 98.5 (101.5) H x 29.5 D (mm)
Weight	260g

PB-5/6/7/8/9/11 CHARGING TIME

Battery / Charger	PB-5	PB-6	PB-7	PB-8	PB-9	PB-11
BC-9		15	30			
BC-10	8	8	15	8	8	8
BC-11	1	1	1	1	1	1

Unit : Hour

PB-10 SCHEMATIC DIAGRAM

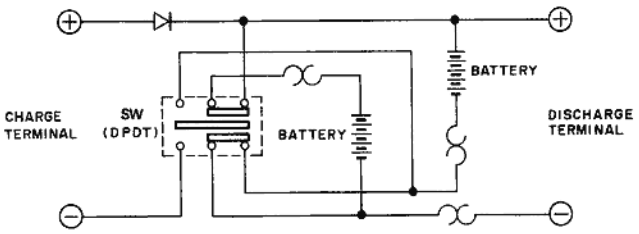


PB-10 SPECIFICATIONS

Electrical characteristic

Voltage	7.2V (1.2V x 6)
Charging current	600mAh
Dimensions	58W x 55.5 (58.5) H x 29.5 D (mm)
Weight	180g

PB-11 SCHEMATIC DIAGRAM



PB-11 SPECIFICATIONS

Electrical characteristic

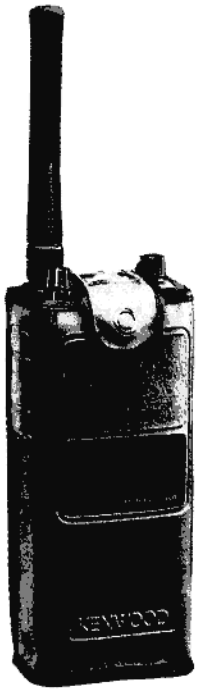
Voltage	Ⓐ 12V (1.2V x 10) Ⓑ 6V (1.2V x 5)
Charging current	Ⓐ 600mAh Ⓑ 1200 mAh
Dimensions	58 W x 98.5 (101.5) H x 29.5 D (mm)
Weight	300g

TH-46A/AT/E

SC-24/25/26 (SOFT CASE)
MB-5 (MOBILE BRACKET)/WR-1 (WATERPROOF CASE)

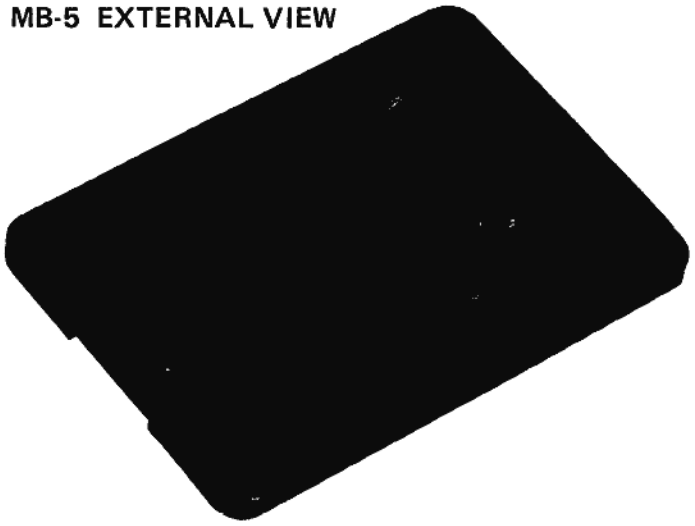
SC-24 EXTERNAL VIEW

SC-25 EXTERNAL VIEW

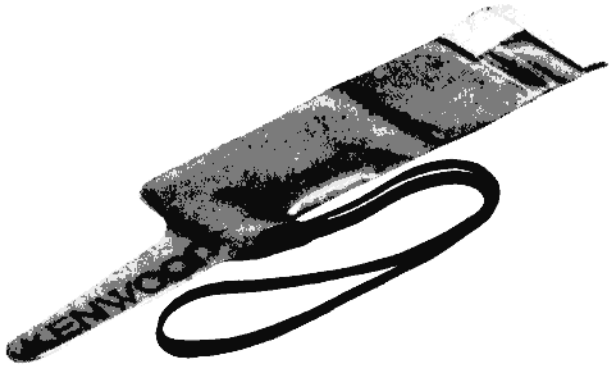


SC-26 EXTERNAL VIEW

MB-5 EXTERNAL VIEW



WR-1 EXTERNAL VIEW



MB-5 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		N99-0320-05	Screw set

SMC-31/32 (SPEAKER MICROPHONE)

SMC-31 EXTERNAL VIEW

SMC-32 EXTERNAL VIEW

SMC-31 SPECIFICATIONS

Electrical characteristic

- **Speaker**
  - Diameter . . . . . φ45 (mm)
  - Impedance 8Ω
  - Rated input power 0.15W
  - Max. input power 0.3W
- **Microphone**
  - Sensitivity . . . . . 66dB ± 3dB at 1300Hz
  - Output impedance . . . . . 2kΩ ± 30% at 1000Hz

SMC-32 SPECIFICATIONS

Electrical characteristic

- **Speaker**
  - Diameter . . . . . φ28 (mm)
  - Impedance 8Ω
  - Rated input power 0.5W
  - Max. input power 1W
- **Microphone**
  - Sensitivity . . . . . 66dB ± 3dB at 1300Hz
  - Output impedance . . . . . 2kΩ ± 30% at 1000Hz

SMC-31 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		D10-0605-08	PTT lever
		E30-2110-05	Curl cord ass'y
		J19-1360-08	Clip
		T07-0219-08	Speaker
		T97-1024-08	Microphone

SMC-32 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		E30-2127-08	Curl cord ass'y

TH-46A/AT/E

SMC-33 (SPEAKER MICROPHONE)

SMC-33 EXTERNAL VIEW

SMC-33 SPECIFICATIONS

Electrical characteristic

- **Speaker**
  - Diameter ..... ϕ28(mm)
  - Impedance 8Ω
  - Rated input power 0.5W
  - Max.input power 1W
- **Microphone**
  - Sensitivity ..... 58dB±3dB (0dB = IV/μbar) at 1300Hz
  - Output impedance ..... 2kΩ ± 30% at 1000 Hz

SMC-33 PARTS LIST

* : New Parts

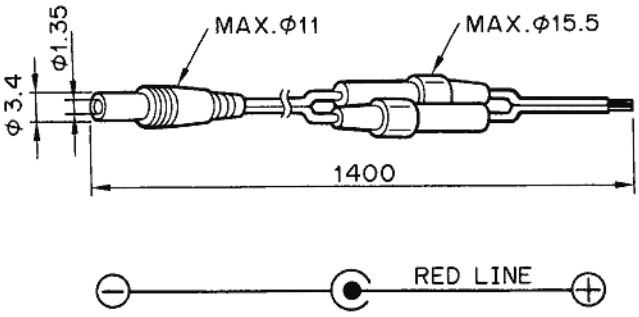
Ref No.	New Parts	Parts No.	Description
		E30-2196-08	Curl Cord Assy
		T91-0392-05	Microphone with Speaker

PG-2W (DC CORD)/PG-3F (PLUG WITH CORD)

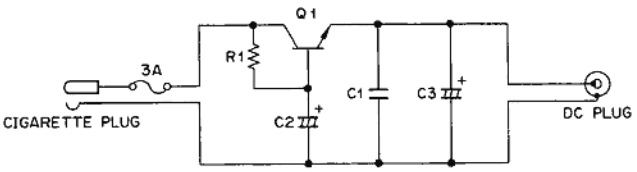
PG-2W EXTERNAL VIEW

PG-3F EXTERNAL VIEW

PG-2W MAIN EXTERNAL DIMENSIONS



PG-3F CIRCUIT DIAGRAM



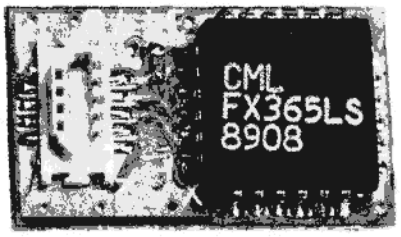
Q1 : 2SD717 (O,Y)
R1 : 22Ω 1/4W

C1 : 0.001μF 50V
C2 : 2.200μF 16V
C3 : 100μF 16V

TH-46A/AT/E

TSU-7 (CTSS UNIT)

TSU-7 EXTERNAL VIEW



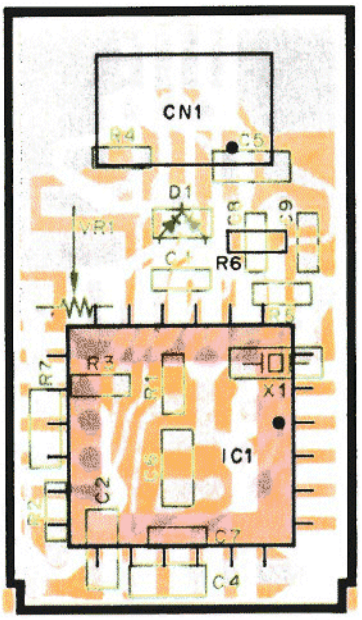
TSU-7 PARTS LIST

Ref. No	Address	Part	Parts No.	Description	Destination	Remarks
TSU-7 (X52-3170-00)						
			G10-0692-04	CUTTION		
			H21-0704-04	CUTTION		
X1		*	L78-0062-05	XTAL (1MHz)		
IC1		*	FX365LS	IC		
D1			DAN202U	DIODE		
VR1			R12-6427-05	TRIM. POT. (47K)		
R1			RK73BG1J105J	CHIP R J 1M		
R2			RK73BG1J824J	CHIP R J 820K		
R3			RK73BG1J154J	CHIP R J 150K		
R4			RK73BG1J103J	CHIP R J 10K		
R5			RK73BG1J105J	CHIP R J 1M		
R6			RK73BG1J473J	CHIP R J 47K		
C1			CK73GB1H471K	CHIP C K 470pF		
C2-6			CK73FB1E104K	CHIP C K 0.1UF		
C7			CK73GB1H471K	CHIP C K 470pF		
C8. 9			CC73GCH1H221J	CHIP C J 220pF		

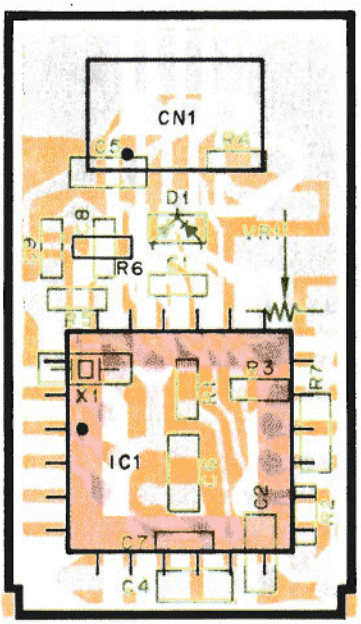
TSU-7 (CTCSS UNIT)

TSU-7 PC BOARD VIEWS

[Component side view]

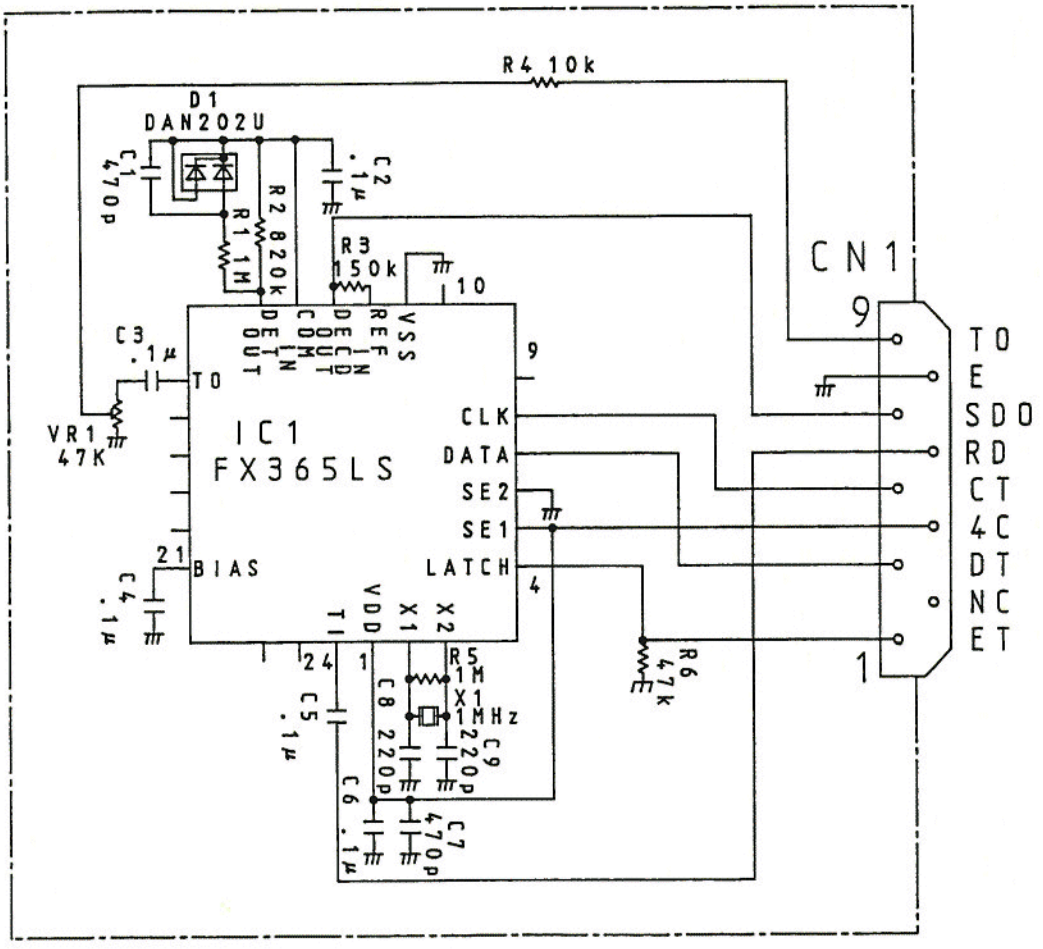


[Foil side view]



: Component side pattern : Foil side pattern

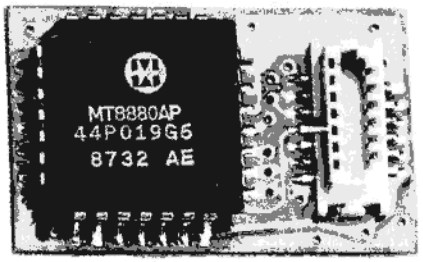
TSU-7 CIRCUIT DIAGRAM



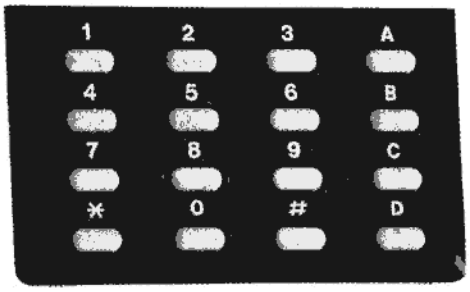
TH-46A/AT/E

DTU-1 (DTMF UNIT)/DTP-1 (KEY PAD UNIT)

DTU-1 EXTERNAL VIEW



DTP-1 EXTERNAL VIEW



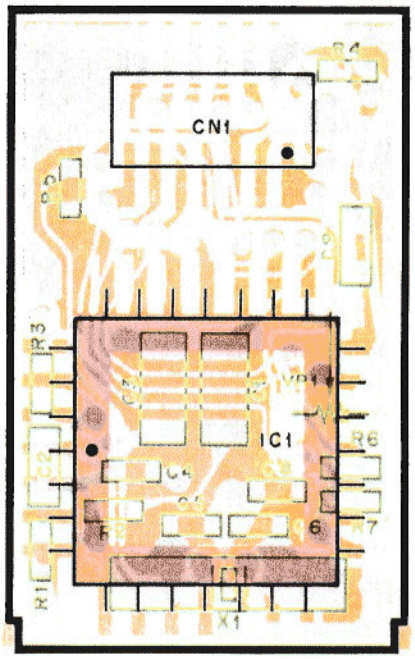
DTU-1 PARTS LIST

Ref. No	Address	Part	Parts No.	Description	Destination	Remarks
DTU-1 (X52-3160-00)						
			G10-0692-04	CUTTION		
			H21-0704-04	CUTTION		
X1		*	L78-0061-05	XTAL (3.58MHz)		
IC1		*	MT8880AP	IC		
VR1			R12-6428-05	TRIM. POT. (68K)		
R1.2			RK73BG1J104J	CHIP R J 100K		
R3			RK73BG1J334J	CHIP R J 330K		
R4			RK73BG1J332J	CHIP R J 3.3K		
R5			RK73BG1J223J	CHIP R J 22K		
R6			RK73BG1J103J	CHIP R J 10K		
C1-3			CK73FB1E104K	CHIP C K 0.1UF		
C4			CK73GB1H471K	CHIP C K 470pF		
C5.6			CC73GCH1H330J	CHIP C J 33pF		
C7			CK73GB1H103K	CHIP C K 0.01UF		
C8			CC73CH1H101J	CHIP C J 100pF		
C9			CK73FB1E104K	CHIP C K 0.1UF		

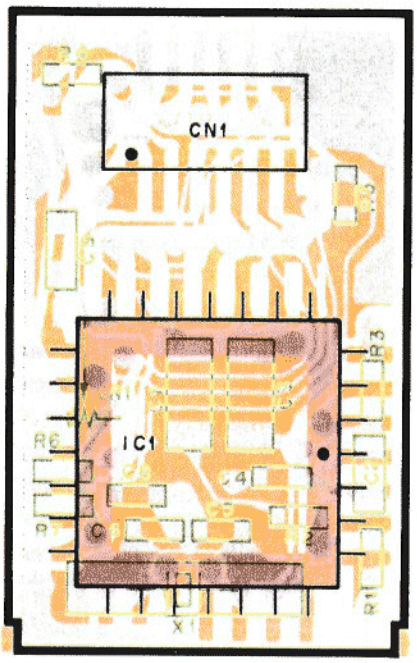
DTU-1 (DTMF UNIT)

DTU-1 PC BOARD VIEWS

[Component side view]

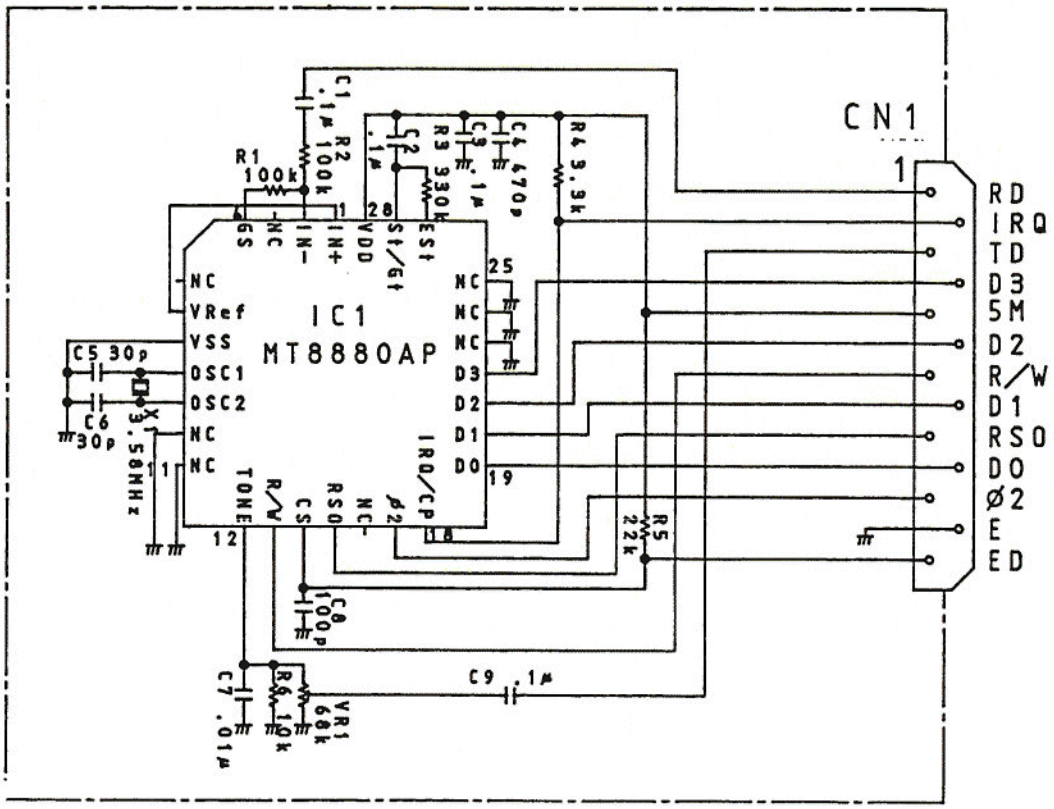


[Foil side view]



: Component side pattern : Foil side pattern

DTU-1 CIRCUIT DIAGRAM



TH-46A/AT/E

SPECIFICATIONS

GENERAL	FREQUENCY RANGE	U.S.A. version		438 ~ 450 MHz
		European and U.K. version		430 ~ 440 MHz
		Others		430 ~ 440 MHz or 438 ~ 450 MHz
	MODE			F3E (FM)
	MEMORY CHANNELS			20 + 1 (Call Channel)
	ANTENNA IMPEDANCE			50 Ω
	POWE REQUIREMENT	External power supply		6 ~ 16 VDC (13.8 VDC nominal)
		Battery terminal		5 ~ 15 VDC
	CURRENT DRAIN	HI	13.8 V (Ext. power suppply)	Less than 2.0 A
			7.2 V (Battery)	Approx. 1.0 A
		LO transmit mode		Approx. 0.6 A
		EL transmit mode		Approx. 0.15 A
		RECEIVE mode with no signal		Approx. 65 mA
		BATTERY SAVER mode		Approx. 17 mA
		AUTOMATIC POWWER OFF mode		Approx. 6 mA
	GROUND			Nagative
	DIMENSIONS (W x H x D)	Projections not included		58 x 135.5 x 29.5 mm (2-9/32" x 5-11/32" x 1-5/32")
		Projections included		68.5 x 147.5 x 34 mm (2-11/16" x 5-13/16" x 1-11/32")
	WEIGHT	With NiCd Battery and Antenna		380 g (0.84 lbs)
	OPERATING TEMPERATURE			–20°C ~ +60°C (–4°F ~ 140°F)
	MICROPHONE IMPEDANCE			2 kΩ
TRANSMITTER	OUTPUT POWER	HI	13.8 V (Ext. power supply)	More than 5 W
			7.2 V (Battery)	Approx. 2 W
		LO		Approx. 0.5 W
		EL		Approx. 20 mW
	MODULATION			REACTANCE
	MAXIMUM FREQUENCY DEVIATION			±5 kHz
	SPURIOUS RADIATION			Less than –60 dB
RECEIVER	DUTY CYCLE OPERATION			1 minute transmission 3 minutes reception recommended
	CIRCUITRY			DOUBLE CONVERSION SUPERHETERODYNE
	INTERMEDIATE FREQUENCY	1st IF		30.825 MHz
		2nd IF		455 kHz
	SENSITIVITY	12 dB SINAD		Less than 0.18 µV
	SQUELCH SENSITIVITY			Less than 0.1 µV
	SELECTIVITY	–6 dB		More than 12 kHz
		–40 dB		Less than 28 kHz
	AUDIO OUTPUTPOWER (across 8 Ω load 10% distortion) distortion)			More than 200 mW

Note
Circuit and ratings are subject to change without notice, due to development in technology.

KENWOOD CORPORATION

Shionogi Shibuya Building, 17-5, 2-chome Shibuya, Shibuya-ku, Tokyo 150, Japan

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 East Dominguez St., Long Beach, CA 90801-5745, U.S.A.

KENWOOD ELECTRONICS DEUTSCHLAND GMBH
Rembrücker Str. 15, 6056 Heusenstamm, West Germany

KENWOOD ELECTRONICS BENELUX N.V.
Mechelsesteenweg 418 B-1930 Zaventem, Belgium

TRIO-KENWOOD FRANCE S.A.
13, Boulevard Ney, 75018 Paris, France

KENWOOD LINEAR S.P.A.
20125, Milano-via Arbe, 50, Italy

KENWOOD ELECTRONICS AUSTORALIA PTY. LTD.
(INCORPORATED IN N.S.W.)
4E. Woodcock Place, Lane Cove, N.S.W. 2066, Australia

KENWOOD & LEE ELECTRONICS, LTD.
Wang Kee Bilding, 5th Floor, 34-37, Connaught Road, Central, Hong Kong

KENWOOD ELECTRONICS CANADA INC.
P.O. BOX 1075, 959 Gana Court, Mississauga, Ontario, Canada L4T 4C2