144MHz FM TRANSCEIVER

TH-22A/AT/E

SERVICE MANUAL

KENWOOD

B51-8239-00 (B) 1408

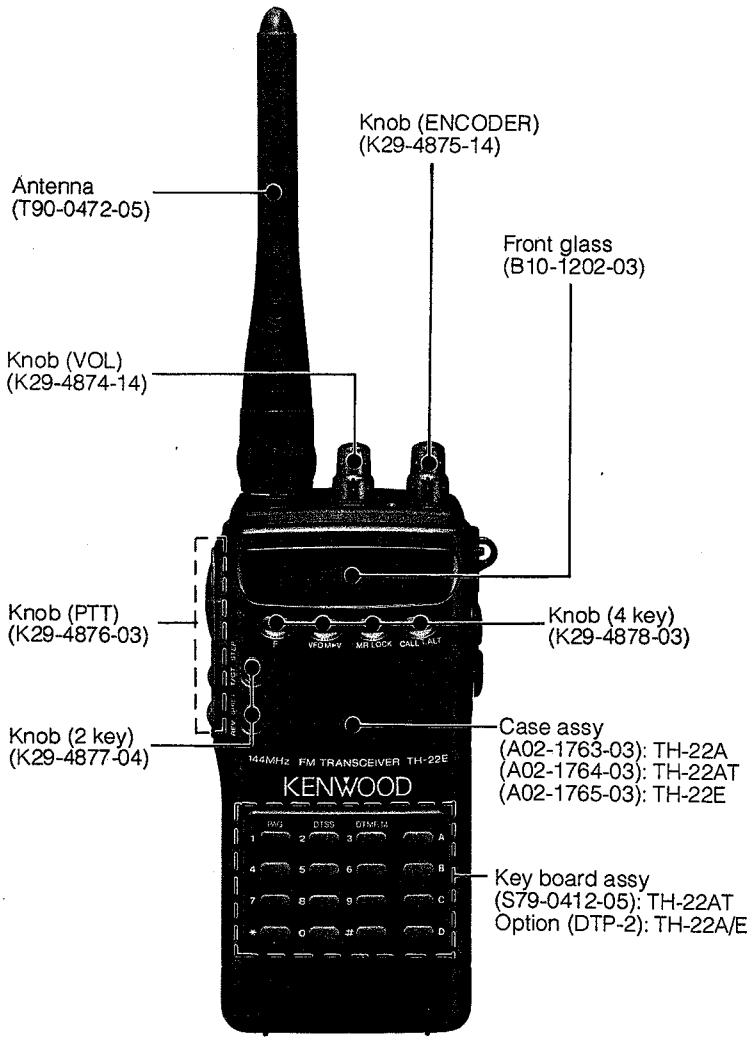


PHOTO is TH-22E (WITH DTP-2)

CONTENTS

TH-22A/AT/E

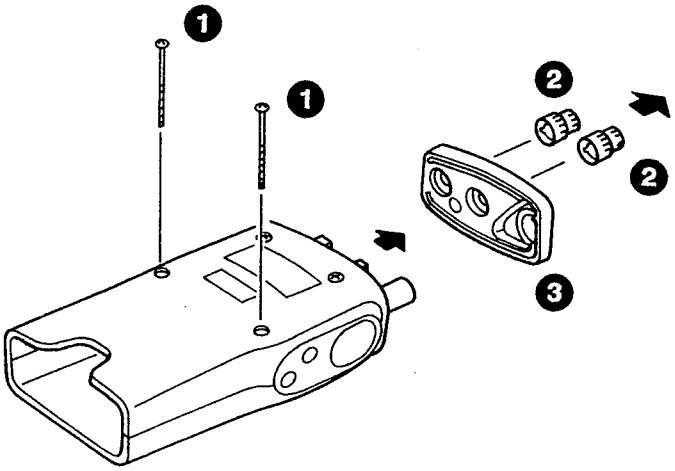
DESTINATION LIST

Type		Unit	Freq. range (Guaranteed specification)	Supplied battery (DC)	Supplied charger (AC)	16-key pad (DTP-2)
TH-22AT	K	X57-4370-11	144 to 148 MHz	6V 600mAh	120V	Installed
TH-22E	T	X57-4372-71	144 to 146 MHz	6V 600mAh	240V	Option
TH-22A	X	X57-4370-71	144 to 148 MHz	Battery case (BT-9)	–	Option
TH-22AT	P	X57-4370-11	144 to 148 MHz	6V 600mAh	120V	Installed
TH-22E	E1	X57-4372-71	144 to 146 MHz	6V 600mAh	230V	Option
TH-22E	E2	X57-4372-72	144 to 146 MHz	6V 600mAh	230V	Option
TH-22E	E3	X57-4372-71	144 to 146 MHz	6V 600mAh	230V	Option
TH-22E	E4	X57-4372-71	144 to 146 MHz	9.6V 600mAh	230V	Option
TH-22E	E9	X57-4372-71	144 to 146 MHz	6V 600mAh	230V	Option
TH-22A	M1	X57-4370-21	144 to 148 MHz	6V 600mAh	120/230V	Option
TH-22A	M2	X57-4370-22	144 to 148 MHz	6V 600mAh	120/230V	Option
TH-22A	M3	X57-4370-22	144 to 148 MHz	9.6V 600mAh	120/230V	Option
TH-22A	M4	X57-4370-22	144 to 148 MHz	Battery case (BT-9)	–	Option
TH-22A	M5	X57-4370-23	144 to 146 MHz	Battery case (BT-9)	–	Option
TH-22AT	M1	X57-4370-21	144 to 148 MHz	6V 600mAh	120/230V	Installed
TH-22AT	M2	X57-4370-22	144 to 148 MHz	6V 600mAh	120/230V	Installed
TH-22AT	M3	X57-4370-22	144 to 148 MHz	9.6V 600mAh	120/230V	Installed
TH-22AT	M4	X57-4370-22	144 to 148 MHz	Battery case (BT-9)	–	Installed

DISASSEMBLY FOR REPAIR

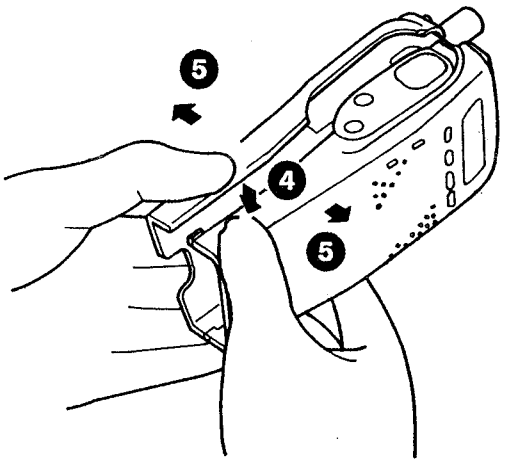
Removing the case

1. Remove the two long screws (❶) of the rear case. Then pull out the two knobs (❷) and remove the rubber panel (❸).



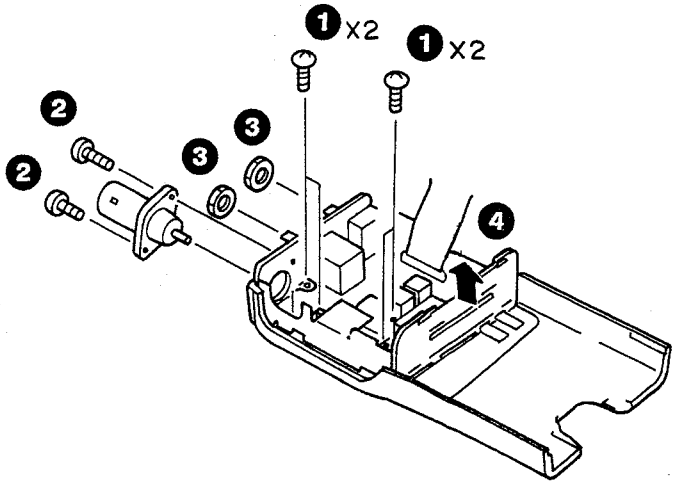
2. Press on the part of the case with a claw (❹) and take apart the upper and lower cases(❺).

Note: As the cases are connected with an FFC cable, take care not to cut the cable when taking apart the cases.



Removing the units

1. Remove the four screws (❶) that are holding the TX-RX unit (A/4).
2. Remove the BNC receptacle after having removed the two screws (❷) and the solder of the terminal.
3. Remove the two nuts (❸) and lift up the unit (❹) to remove it from the case.



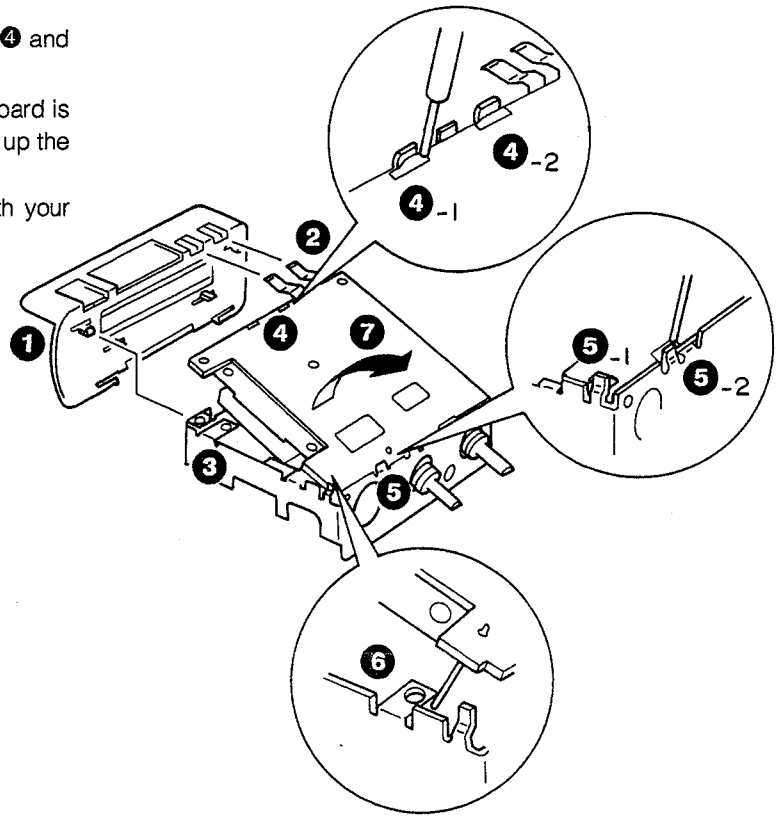
TH-22A/AT/E

DISASSEMBLY FOR REPAIR

Removing the circuit board

1. Pull out the holder (❶) from the frame (❸) without bending the power supply terminal (❷).
2. Remove the solder from the four soldered points (❹ and ❺) of the circuit board and the frame.
3. Take care so that the ANT terminal of the circuit board is not caught on the frame (❻), and then carefully lift up the circuit board (❼) from the frame.

Note: Take care not to touch the power module with your fingers.



CIRCUIT DESCRIPTION

FREQUENCY CONFIGURATION

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

(1) 144.000 to 147.995 MHz (K, P, M1-4, X)
144.000 to 145.995 MHz (T, E, M5)

(2) 189.05 to 193.045 MHz (K, P, M1-4, X)
189.05 to 191.045 MHz (T, E, M5)

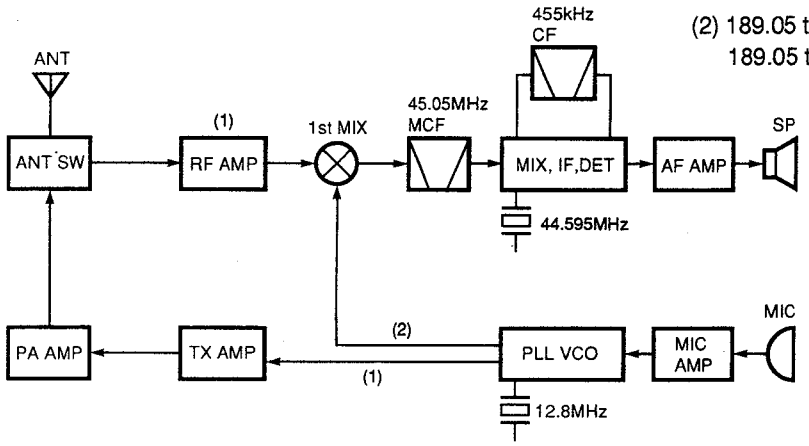


Fig. 1 Frequency configuration

Receiving system	Double superheterodyne system	
	First IF	45.05 MHz
	Second IF	455 kHz
Transmitting system	Direct conversion oscillating amplification system	
Modulation system	Variable reactance phase modulation	

Table 1 Basic configuration

RECEIVER SYSTEM

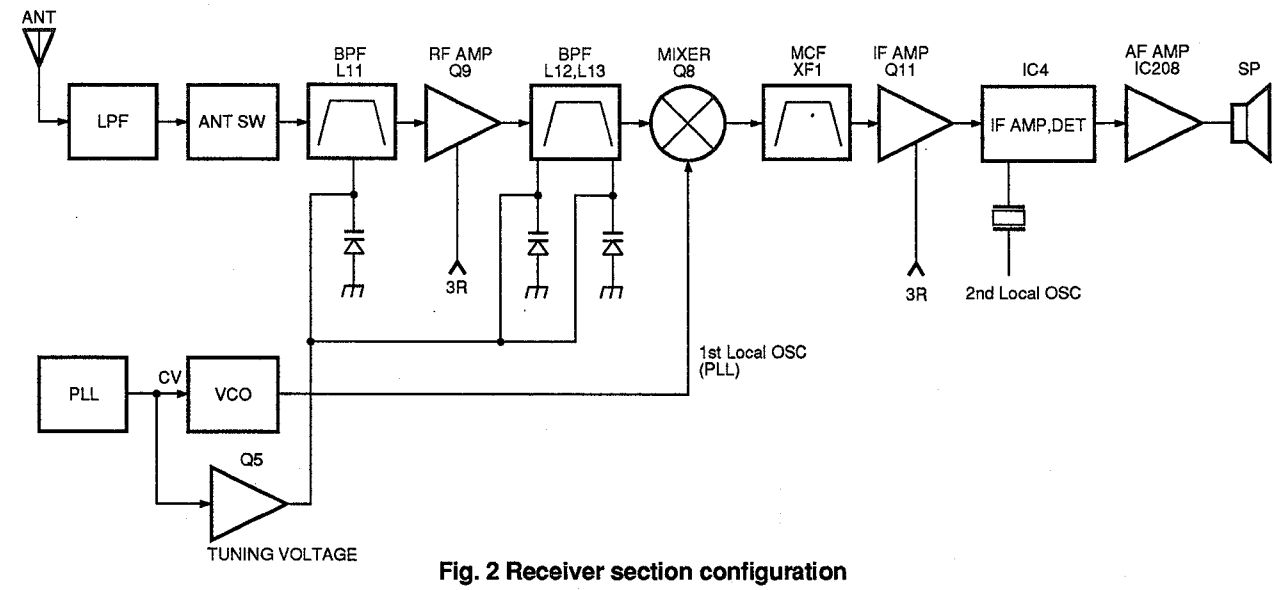


Fig. 2 Receiver section configuration

• RF amplifier

The signal from the antenna is passed through a low-pass filter and the transmission/reception selector circuit, and input to the RF amplifier. The input signal is amplified by Q9. The unwanted frequency band of the signal is then eliminated by a band-pass filter.

This band-pass filter is a variable filter using a varicap, and operates so that it tunes to the receive frequency with the tuning voltage that is in proportion to the PLL lock voltage.

• First-stage mixer

The input signal is mixed with the first local oscillator signal from the PLL circuit by the first-stage mixer Q8, producing a first IF signal. The unwanted frequency band of the first IF signal is eliminated by a two-stage monolithic crystal filters (MCF).

Item	Rating
Nominal center frequency (fo)	45.05 MHz
Passband width	±7.5 kHz or more at 3 dB
Attenuation band width	±22 kHz or less at 25 dB
Guaranteed attenuation	80 dB or more at ±910 kHz Spurious: 40 dB or more within ±1 MHz
Ripple	1 dB or less
Insertion loss	4 dB or less
Terminating impedance	800 Ω/2 PF

Table 2 MCF (L71-0409-05) characteristics (TX-RX unit XF1)

CIRCUIT DESCRIPTION

• IF amplifier

The first IF signal is amplified by Q11 and enters IC4 (FM signal processing IC), where it is mixed with the second local oscillator signal and so converted into the second IF signal. The unwanted frequency band of the second IF signal is eliminated by ceramic filter CF1. The resulting signal is then amplified and detected.

Item	Rating
Center frequency of 6dB bandwidth (fo)	Within 455 kHz±1.5 kHz
6dB bandwidth	±7.5 kHz or more
40dB bandwidth	±15 kHz or less
Passband ripple	1.5 dB or less (within 455±1.5 kHz)
Guaranteed attenuation	27 dB or more (within ±100 kHz)
Insertion loss	6 dB or less
Input/output impedance	1.5 kΩ

Table 3 Ceramic filter (L72-0362-05) characteristics (TX-RX unit CF1)

• AF amplifier

The frequency characteristics of the audio signal output by the FM detector are corrected by the Q12 active high-pass filter and deemphasis circuit consisting of R67 and C71. The audio signal is then passed through an AF variable resistor and amplified by power amplifier IC208 to obtain the desired output.

• Squelch and mute circuits

The output detected by IC4 is amplified by Q10, waveform shaped by D16 and C80, and the direct current is input to the microprocesser analog port (pin 5). The voltage input to the microprocesser is digitized, and the microprocesser controls the MUTE, AFC0, and AFC1, thus controlling the audio signal. This port has hysterisis. The microprocesser also controls the MUTE, AFC0, and AFC1 during the T. ALT, CTCSS and DTSS operations, thus controlling the audio signal.

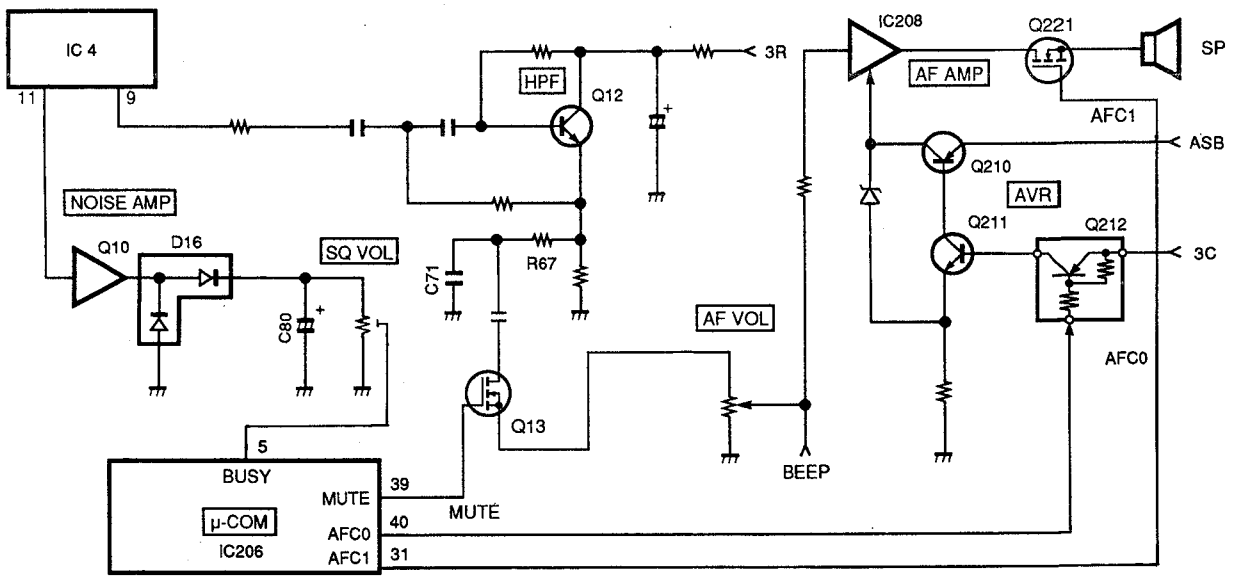


Fig. 3 AF amplifier, squelch, and mute circuits

Condition			MUTE	AFC0	AFC1
Transmission			L	H	L
Reception	Normal operation	Squelch on	L	H	L
		Squelch off	H	L	H
	Bell operation	Standby	L	H	L
		Receive (Bell operation)	L	L	H

MUTE: Muted when low
AFC0: Muted when high
AFC1: Muted when low

Table 4 Muting conditions

CIRCUIT DESCRIPTION

• **S meter**

The S-meter signal is output from pin 13 of IC4 as a direct current corresponding to the input signal, converted to a voltage by R83, then input to pin 3 of the microprocesser. The DC voltage is digitized to control the LCD S-meter display. The S-meter display level is written into the EEPROM of each unit during adjustment in the factory. Thus there is little variation in the product level.

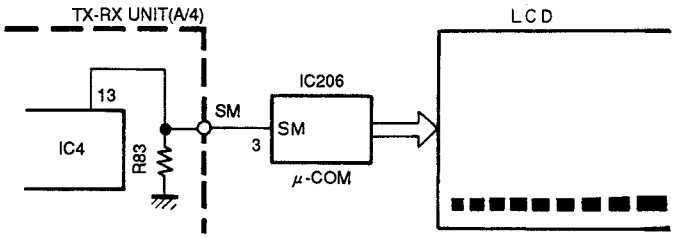


Fig. 4 S meter

TRANSMITTING SYSTEM

• **Microphone amplifier**

The audio band of the signal from the microphone is corrected by the 6dB/oct preemphasis circuit consisting of C235 and R244. The 18dB/oct tone frequency is eliminated by the low-pass filter consisting of C236, R245, C239 and R239 and the preemphasis circuit. The signal is amplified and limited by IC207 (1/2). Distortion components exceeding the audio band of the resulting signal are then eliminated by 18dB/oct frequency correction by a splatter filter consisting of IC207 (2/2) and R235 and C230.

• **Modulation circuit**

The signal from the microphone amplifier passes through the modulation adjustment variable resister VR202, is applied to VCO varicap diode D3, and modulated by variable reactance.

• **Drive and Final Circuit**

The desired signal is produced by the VCO, and amplified to about 75 mVrms by the buffer amplifier. It is then amplified to about 1.4 Vrms by the drive. The amplified signal is input to power module IC3.

The power module consists of a two-stage FET amplifier, and increases the power to about 5 W.

• **Transmission/reception selector circuit**

The transmission output is passed through the transmission/reception selector circuit and low-pass filter to the antenna.

The transmission/reception selector circuit, which consists of D11 and D12, is turned on during transmission and off during reception to switch the signal.

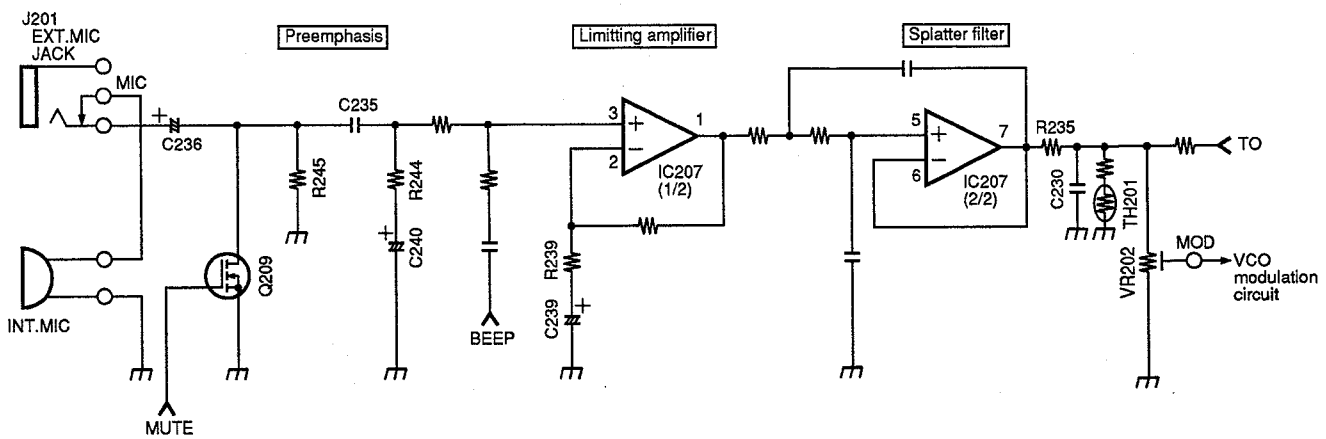


Fig. 5 Microphone amplifier

CIRCUIT DESCRIPTION

• APC and transmission output selector circuits

The automatic power control (APC) circuit is used to obtain a stable transmission current. This circuit detects the drain current in the final stage of the power module and controls the transmission output.

To differential DC amplifier IC204, two voltages are applied: the reference voltage produced by dividing the voltage of constant-current zener diode D202 by variable resistors VR201, R210, R211, and R212 for transmission output adjustment, and the detection voltage generated across R61,R62 and R63 in proportion to the drain voltage in the final stage.

The voltage, proportional to the difference between the reference voltage and the detection voltage, is obtained at the output pin (pin 6) of IC204. This voltage is reversed by Q203 to provide the APC voltage.

This APC voltage controls the power control pin of the power module and stabilizes the transmission output.

When transmission output is changed, each switch is changed as shown in the table below. The reference voltage is changed, and the transmission output is fixed at about 5 W (high), 0.5 W (low), or 50 mW (EL).

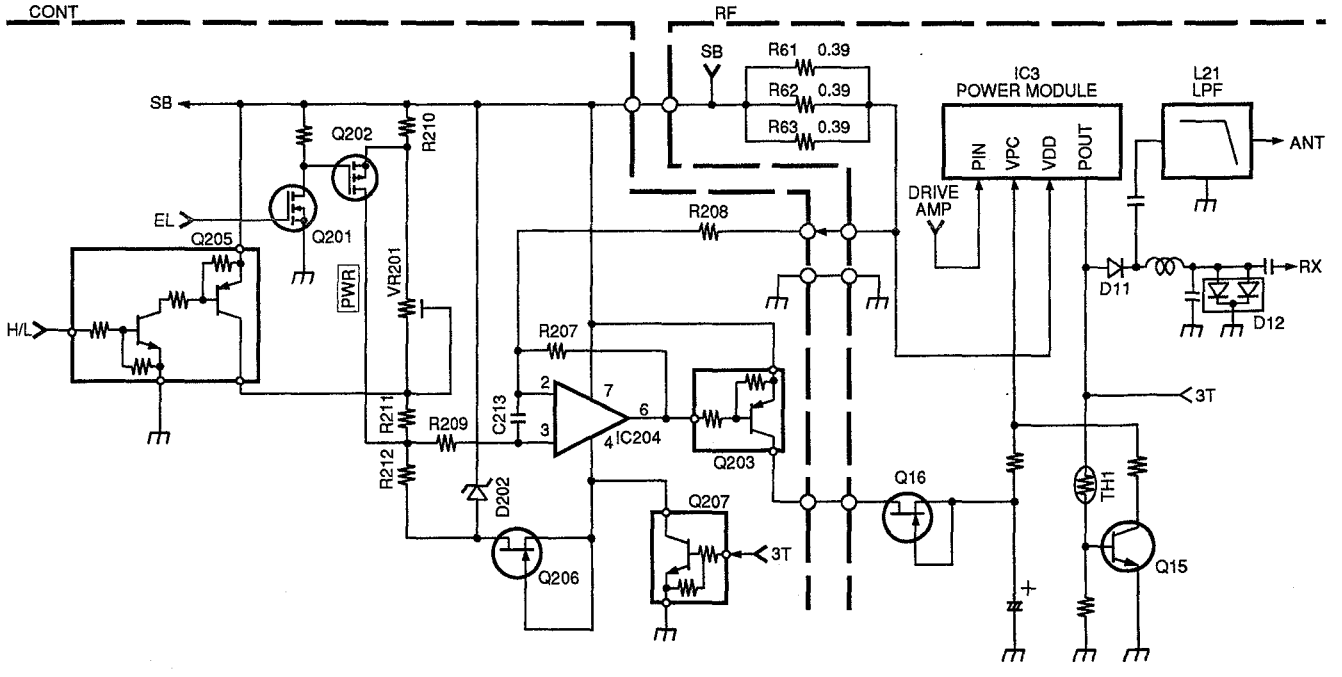


Fig. 6 APC and transmission output selector circuits

H/L and EL are control signals from the microprocessor unit. The logical relationship is shown in the table below.

Transmission output selection	Transmission		Reception	
	H/L	EL	H/L	EL
HI	L	L	L	H
L	H	L	L	H
EL	L	H	L	H

Table 5 Transmission output selecting condition

• Temperature protection circuit

When the thermistor detects about 100°C, the temperature protection circuit turns Q15 on, reduces the APC voltage to prevent thermal damage to the power module.

CIRCUIT DESCRIPTION

PLL CIRCUIT

• PLL

The output from the 12.8 MHz reference oscillator consisting of X1 is divided by IC1 to produce a 5 kHz or 6.25 kHz reference frequency. The comparison frequency is obtained by amplifying the VCO output by Q2 and dividing it by the PLL IC (IC1).

5, 10, 12.5, 15, 20, and 25kHz PLL synthesizer is implemented by phase-comparing the reference frequency and comparison frequency obtained when X1 is divided.

The pulse output from pins 18 and 20 of IC1 according to the difference between the reference frequency and the comparison frequency is passed through the charge pump, and is changed to DC current by a low-pass filter to produce the lock voltage.

The power supply of the charge pump is raised from 3M by the DC-DC converter to increase the lock voltage to about 7 V.

• VCO (X58-4090-00)

The desired frequency is directly produced by the Colpitts oscillator configured around FET Q2. The lock voltage is applied to varicap diodes D1 and D2 to change the oscillator frequency. The TX pin is made "L" during transmission. Q1 and D4 are then turned off to change over the oscillation frequency.

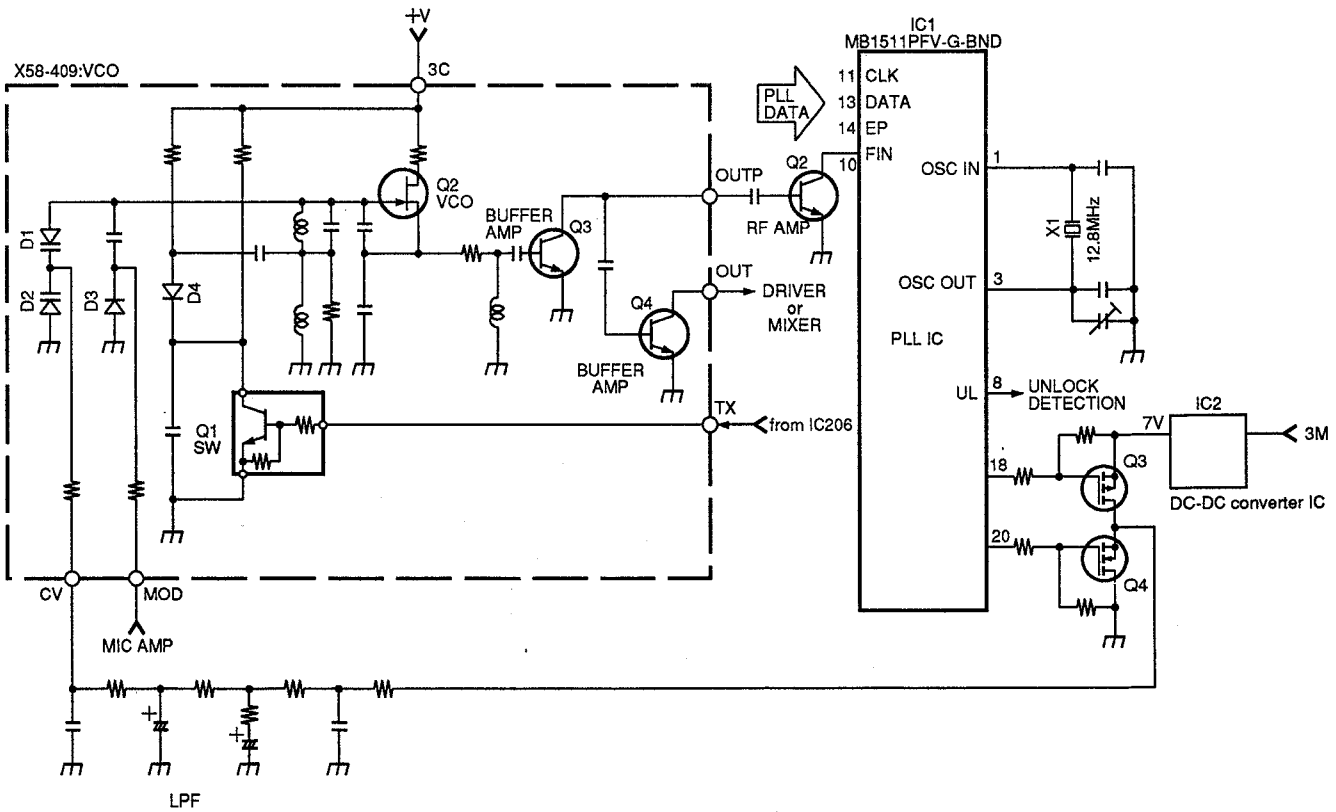


Fig. 7 PLL and VCO circuits

• Unlock detection circuit

When the PLL is in the unlock state, the pulse that is output to the UL pin (pin 8) of IC1 is waveform shaped by D3, C9, R11, and C8. The UL pin is then made high. The voltage at the UL pin is monitored by the microprocessor to control the transmission or reception selection timing.

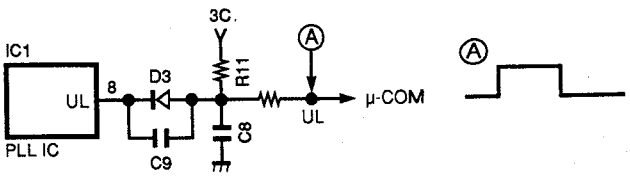


Fig. 8 Unlock detection circuit

CIRCUIT DESCRIPTION

DIGITAL CONTROL CIRCUIT

• **Keys and rotary encoder circuit**

The signal from keys and rotary encoder input to microprocesser directly as shown in Figure 9.

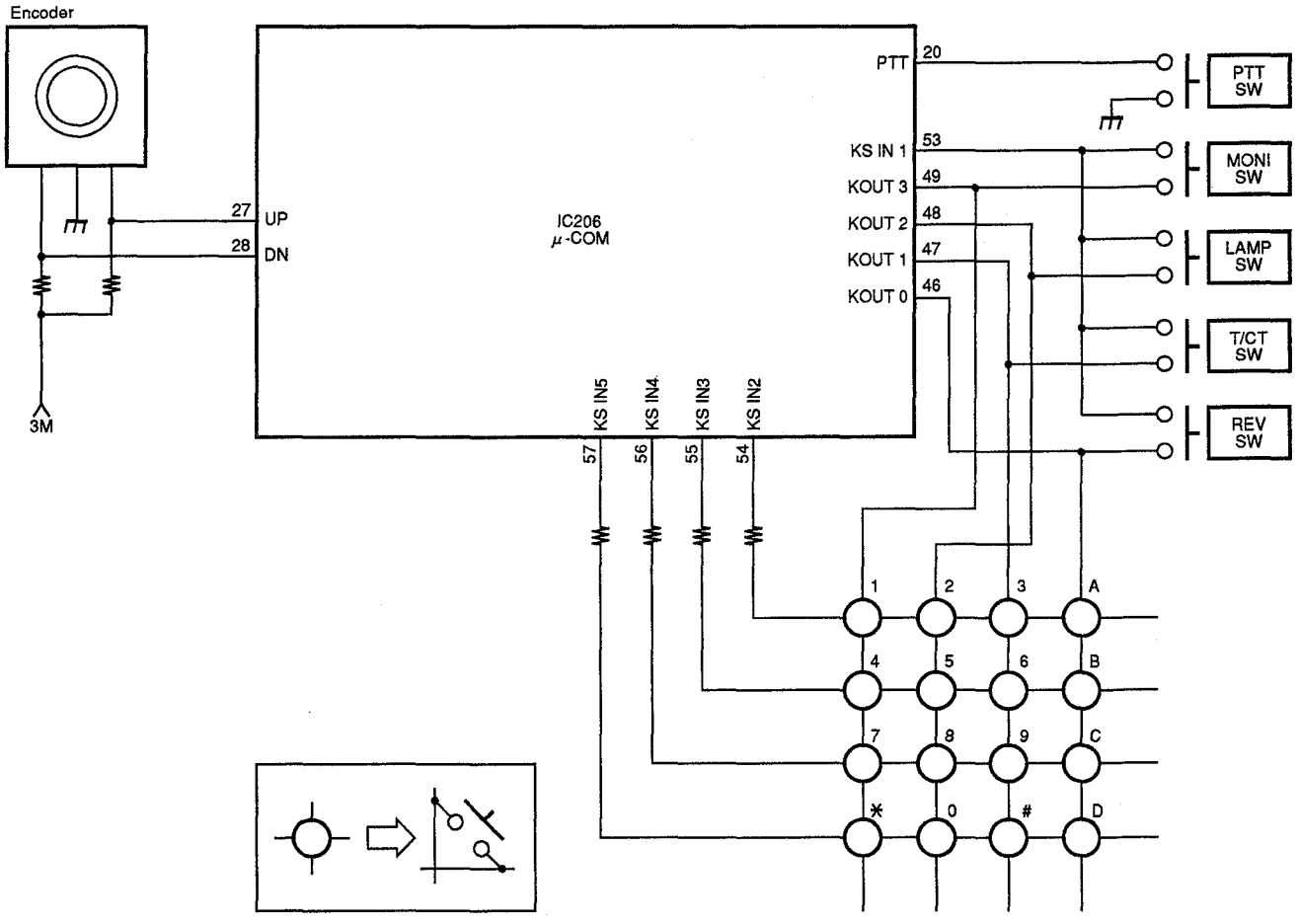


Fig. 9 Keys and rotary encoder circuit

CIRCUIT DESCRIPTION

• Reset and backup circuits

When the SB is turned on, a high-level pulse of about 1.5 ms duration is output from the reset circuit consisting of C267, R287, and Q220 to reset microprocesser IC206. If the SB is turned off, the voltage detection IC IC205 detects a 3M voltage drop, and outputs a low signal. When the INT4 microprocesser port goes low, it outputs data to IC202 (EEPROM) and enters backup mode.

The EEPROM receives data while C208 is discharging, and the data is written internally. The delay circuit consisting of R213 and C265 prevents the microprocesser from resetting during writing, and IC209 (AND IC) speeds rising of the reset pulse.

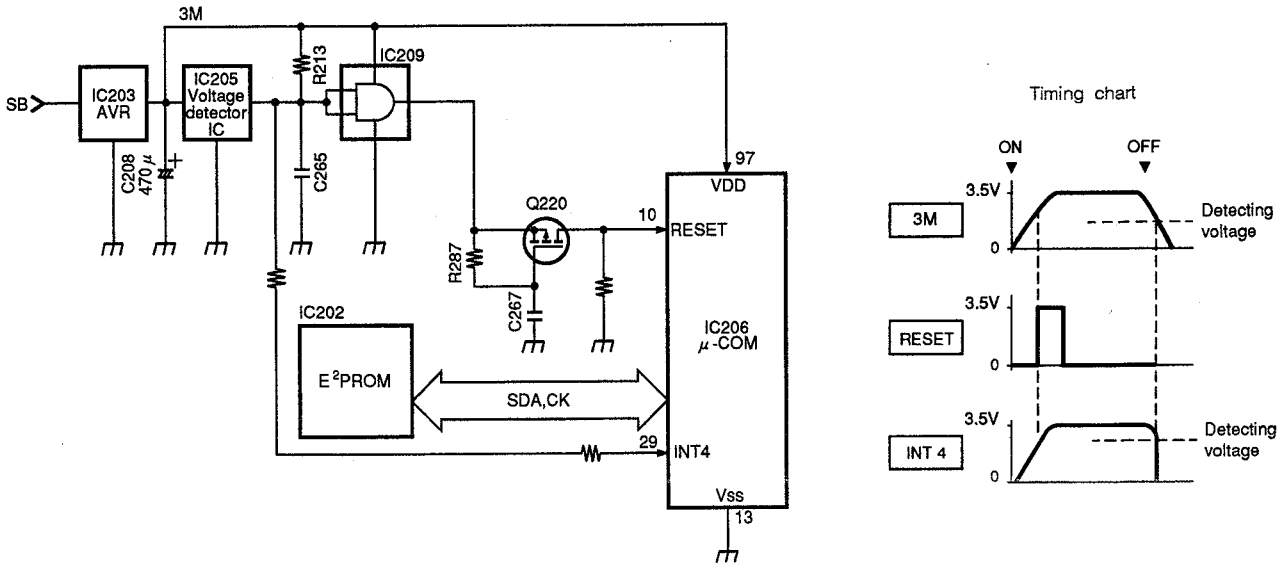


Fig. 10 Reset and backup circuits

• Battery voltage detector circuit

The supply voltage is divided and input to the analog port (pin 2) of the microprocesser. The voltage input to the microprocesser during transmission is digitized to drive the LCD battery display.

• Lamp circuit

The LED is turned on or off by directly flowing current to the microprocessor ports.

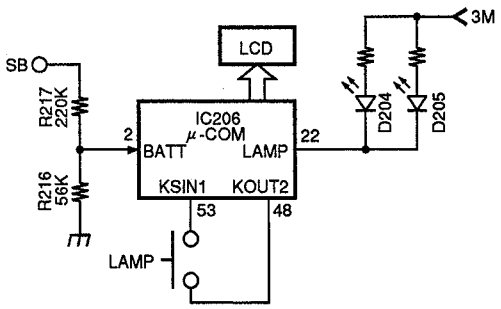


Fig. 11 Battery voltage detector and lamp circuits

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CIRCUIT DESCRIPTION

POWER SUPPLY CIRCUIT

• Nickel-cadmium battery charging circuit

The constant current circuit consisting of Q14 and D18 supplies constant current (about 60 mA) to the Nickel cadmium battery from the external power supply connected to the DC IN pin.

• Power selector circuit

The power circuit configuration is shown in Figure 12. The power circuit branches are as follows:

SB	RB	Power module power supply voltage
	3C	VCO V_{DD} and IC208 AVR reference voltage IC1 (PLL IC) V_{DD}, 3R (receive stage V_{DD} IC4 (FMIC) V_{DD}
	3T	Transmission LED, IC204 V_{DD} switch, drive stage V_{DD}, protection circuit bias voltage, D11; D12 switch (transmission/reception selector switch)
	3M	IC206 (microprocessor) V_{DD}, IC2 (DC-DC comparator) V_{DD}, CTCSS V_{DD}, IC201 (DTMF decoder IC) V_{DD}, IC202 (EEPROM) V_{DD}, LAMP, 3T, 3C, 3R reference voltage
	ASB	IC208 (AF amplifier) V_{DD}

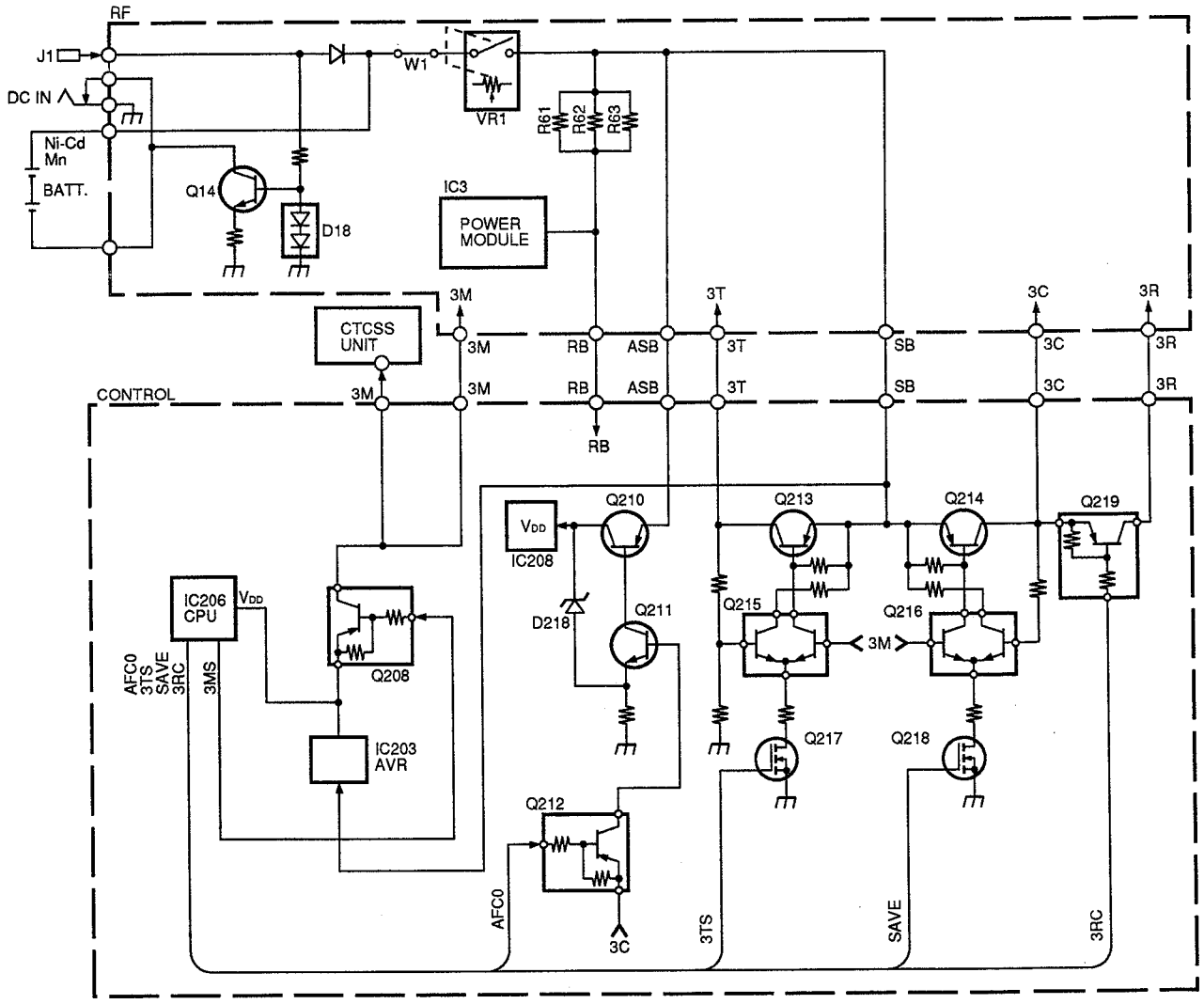


Fig. 12 Power supply circuit

CIRCUIT DESCRIPTION

• Battery save circuit

The squelch is switched in during receive (SCAN OFF). The power circuit enters battery save mode if no key has bean pressed for five seconds.

Q218 is turned on or off in a 200 ms : 800 ms cycle (200 ms : 125 ms if the DTSS or paging function has bean turned on) by the signal output to the SAVE pin of the microprocesser.

As a result, the power consumption in the standby state is reduced by controlling the 3C AVR circuit consisting of Q214 and Q216, turning 3C and 3R on or off.

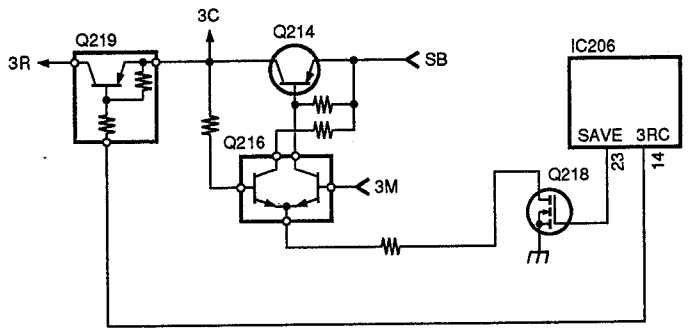
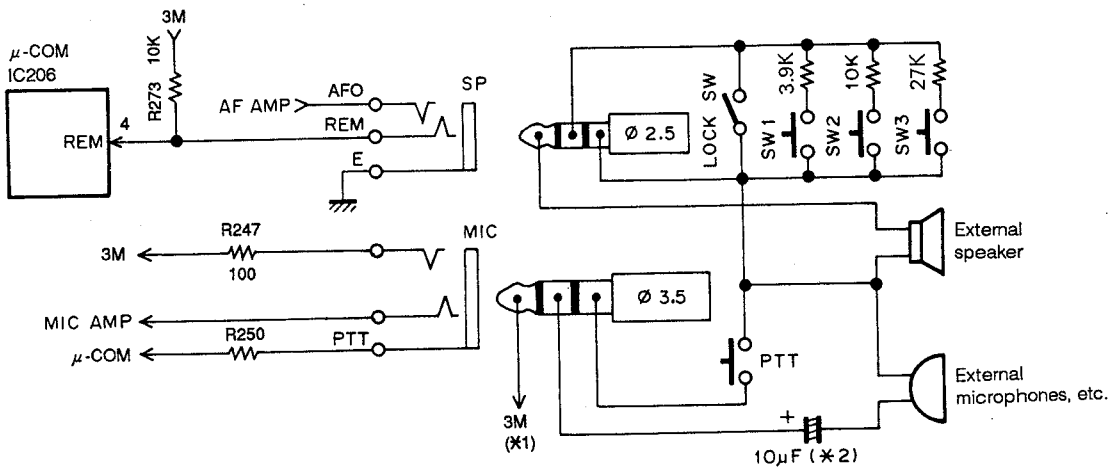


Fig. 13 Battery save circuit

• Remote control circuit

A quantized voltage is applied to the REM (remote) pin of the microprocesser, which invokes appropriate functions according to the voltage level.

The voltage at the REM pin is normally about 3.5 V as a result of R273. When a remote control microphone button is pressed, this voltage is divided by the resistor connected in series with the button switch and by R273. The resulting voltage indicates which button was pressed.



*1: Voltage appears from the internal 3M line (3.5 V) via R247. It is about 3 V when 5 mA flows.

*2: In the following case, the capacitor is not required; connect directly.
When a capacitor to cut DC voltage is connected to the external device.
When a two-terminal capacitor microphone is used as the external microphone.

Fig. 14 Speaker, Microphone jack and Remote control circuits

CIRCUIT DESCRIPTION

SUPPLIED CIRCUIT

• CTCSS

The tone frequency is set by the serial data from the microprocesser (IC206). The audio input signal is the detection output input from the CI pin.

The SDO pin is made low when the tone frequency coincides. The microprocesser determines the SDO pin state and controls the MUTE, AFC0, AFC1 pins.

When the CTCSS signal is transmitted, the CTCSS is output from the microprocesser and modulated.

• DTSS

A DTMF code is input or output as serial data of microprocesser. The audio input signal is input from the CI pin in the same way as in CTCSS. The data is sent to the microprocesser when a DTMF signal is detected. The microprocesser determines the coincidence of the code and controls the MUTE, AFC0, and AFC1 pins.

The DTMF signal is output from the microprocesser during DTMF signal transmission. The DTMF signal is modulated through the microphone amplifier. During DTMF signal transmission, the MUTE pin is made low and the microphone signal is muted. AFC0 and AFC1 are then turned on, and the DTMF signal can be monitored with the speaker.

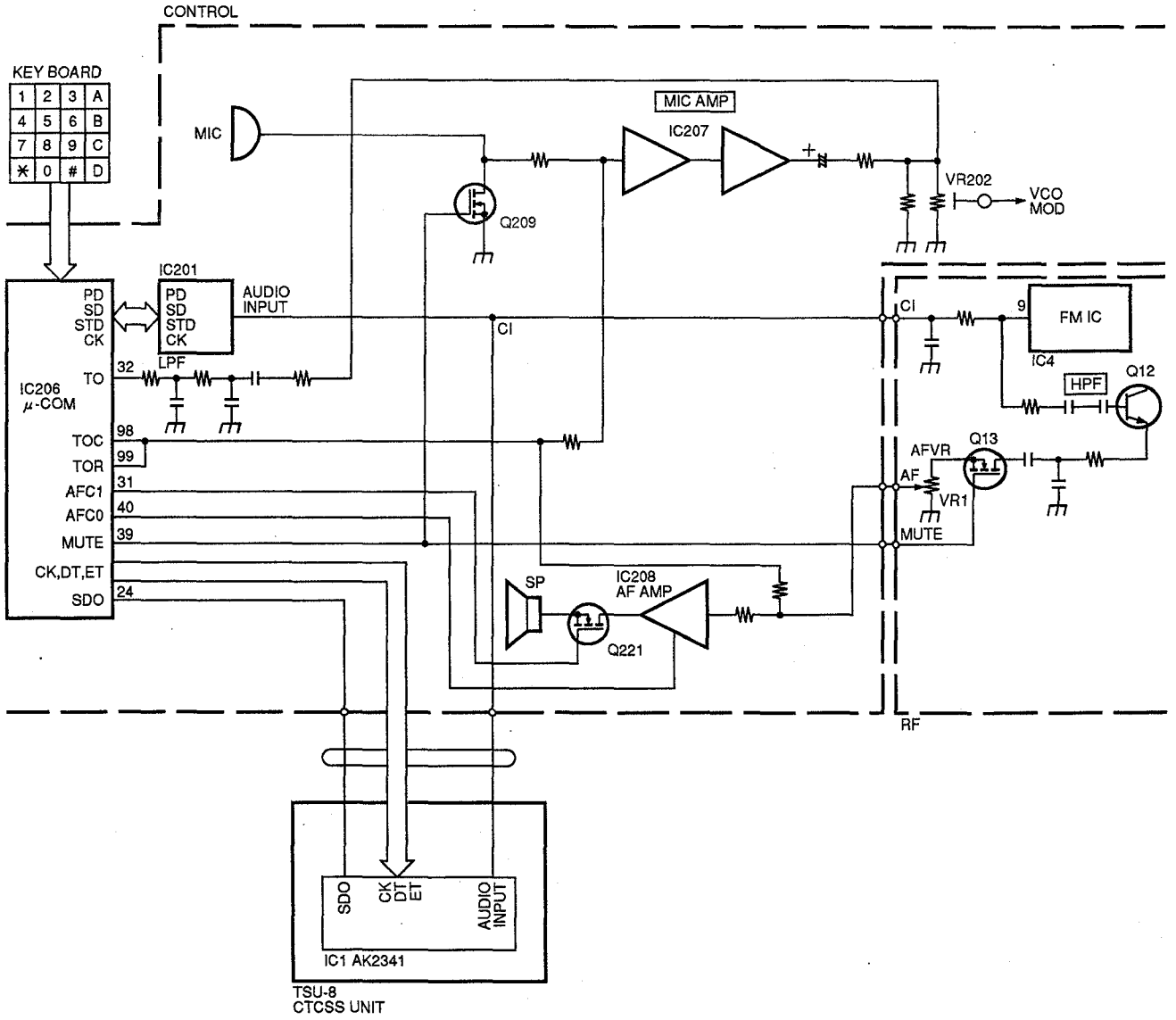
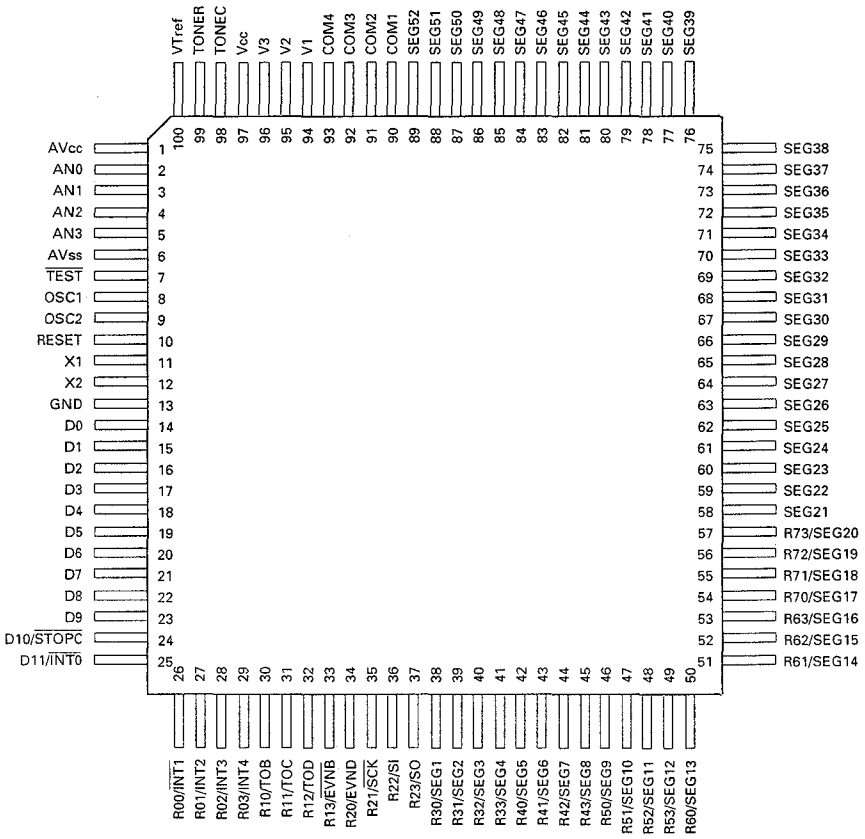


Fig. 15 Supplied circuits connection diagram (DTMF, CTCSS, BEEP, TONE)

SEMICONDUCTOR DATA

Microprocesser : HD404629B17TF control unit (IC206)

• **Pin connection diagram**



• **Pin function**

Pin No.	Pin name	Port name	I/O	Function
1	AVcc	AVCC		A/D converter power supply.
2	AN0	BATT	I	Battery check during transmission.
3	AN1	SM	I	S-meter voltage check.
4	AN2	REM	I	Remote control switch voltage check.
5	AN3	BUSY	I	BUSY port voltage check.
6	AVss	AVSS		AVcc ground.
7	TEST	TEST	I	Connect to Vcc.
8	OSC1	OSC1	I	Internal oscillator input.
9	OSC2	OSC2	O	Internal oscillator output pin.
10	RESET	RESET	I	MCU reset. (↑ edge)
11	X1	X1	I	Connect to Vcc.
12	X2	X2		Release.
13	GND	VSS		GND
14	D0	3RC	O	Receive VCO power supply control output.
15	D1	CK	O	Clock output to PLL, CTCSS, EEPROM, DTMF decoder.
16	D2	DT	O	Data output to PLL, CTCSS, DTMF decoder.

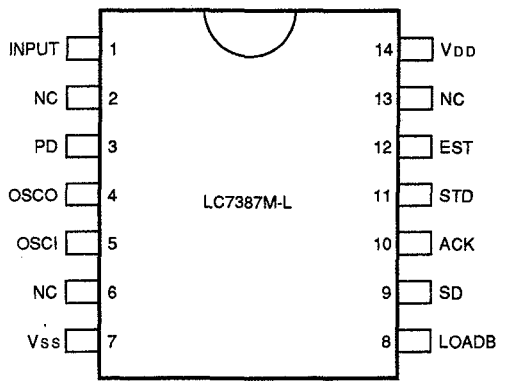
SEMICONDUCTOR DATA

Pin No.	Pin name	Port name	I/O	Function
17	D3	SDA	I/O	EEPROM IC data input/output.
18	D4	CHOFF	I	CH display mode release input.
19	D5	UL	I	PLL IC unlock signal input.
20	D6	PTT	I	PTT SW input.
21	D7	SD	I	DTMF IC data (SD) input.
22	D8	LAMP	O	Lamp control output.
23	D9	SAVE	O	Save power supply control output.
24	D10/STOPC	SD0	I	CTCSS IC tone match signal (DET) input.
25	D11/INT0			Release.
26	R00/INT1	STD	I	DTMF IC data detection (STD) input.
27	R01/INT2	UP	I	Encoder data input.
28	R02/INT3	DN	I	Encoder interrupt input. (↑↓ edge)
29	R03/INT4	INT4	I	Power supply detection port. (↑↓ edge)
30	R10/TOB	BEEP	O	Beep tone, 1750Hz output.
31	R11/TOC	AFC1	O	Audio amplifier power supply control output.
32	R12/TOD	TO	O	Subtone output. (PWM)
33	R13/EVNB	NC		Release.
34	R20/EVND	TX	O	Transmit VCO power supply control output.
35	R21/SCK	3MS	O	Power supply control output (except microprocessor and EEPROM).
36	R22/SI	EL	O	Economic low power control output.
37	R23/SO	H/L	O	Transmission output switching power supply control output.
38	R30/SEG1	3TS	O	Power module power supply control output.
39	R31/SEG2	MUTE	O	Audio mute/microphone mute control output.
40	R32/SEG3	AFC0	O	Audio amplifier power supply control output.
41	R33/SEG4	PD	O	DTMF receiver PD pin control output.
42	R40/SEG5	MRWT	O	Production-time automatic frequency write mode. (↓ edge)
43	R41/SEG6	SMCALL	O	S-meter adjustment mode. (↓ edge)
44	R42/SEG7	ET	O	CTCSS IC chip select (ST) output.
45	R43/SEG8	EP	O	PLL IC chip select (LE) output.
46	R50/SEG9	KOUT0	O	Key scan output 0
47	R51/SEG10	KOUT1	O	Key scan output 1
48	R52/SEG11	KOUT2	O	Key scan output 2
49	R53/SEG12	KOUT3	O	Key scan output 3
50	R60/SEG13	SIN0	I	Destination input 0 (internal pull-up)
51	R61/SEG14	SIN1	I	Destination input 1 (internal pull-up)
52	R62/SEG15	KSIN01	I	Key scan input 0 (internal pull-up)
53	R63/SEG16	KSIN1	I	Key scan input 1 (internal pull-up)
54	R70/SEG17	KSIN2	I	Key scan input 2 (internal pull-up)
55	R71/SEG18	KSIN3	I	Key scan input 3 (internal pull-up)
56	R72/SEG19	KSIN4	I	Key scan input 4 (internal pull-up)
57	R73/SEG20	KSIN5	I	Key scan input 5 (internal pull-up)
58-89	SEG21-52	SEG21, 52	O	LCD display segment signal output (Segments 48-52: release)
90-93	COM1-4	COM1-4	O	LCD display common signal output (COM4: release)
94-96	V1, V2, V3	V1, V2, V3		Release LCD driver power supply.
97	Vcc	VDD		Power supply voltage.
98	TONEC	TOC	O	DTMF signal column side output.
99	TONER	TOR	O	DTMF signal row side output.
100	VTref	VTREF		DTMF output reference level power supply.

SEMICONDUCTOR DATA

DTMF receiver : LC7387M-L (IC201)

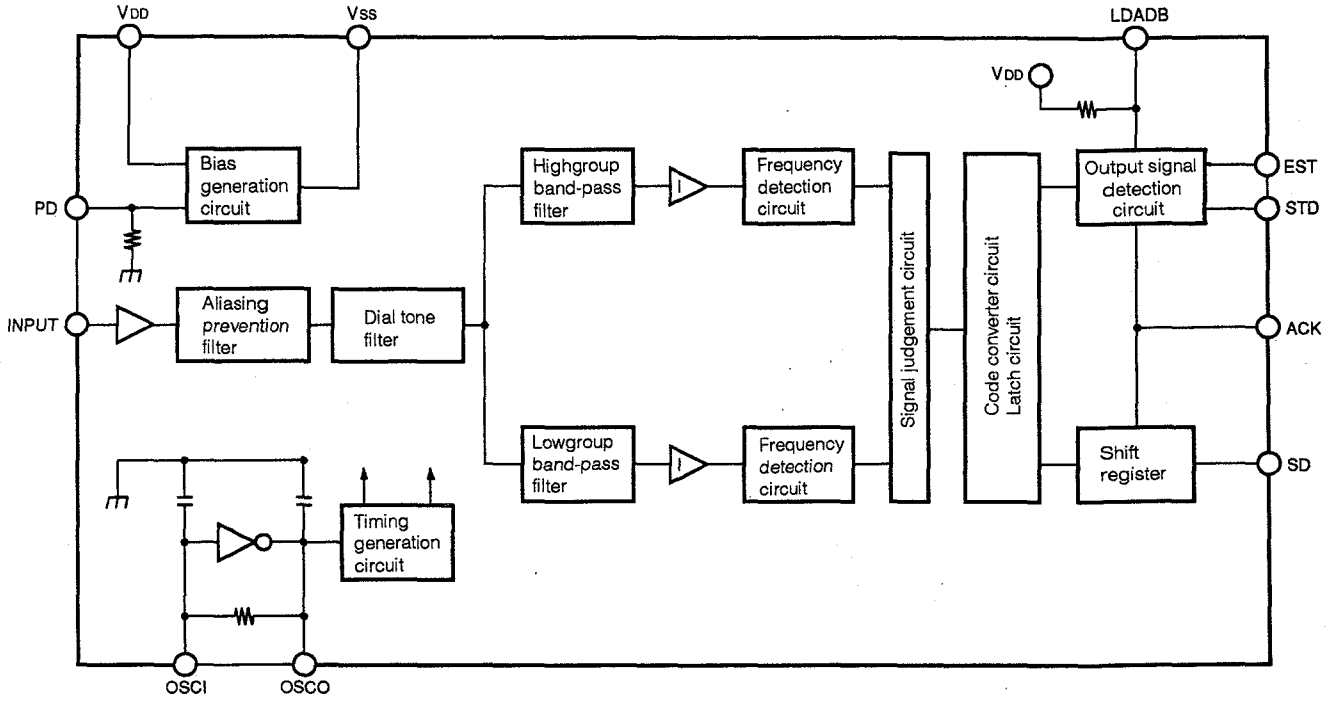
• **Pin connection diagram**



• **Pin description**

Pin No.	Pin name	I/O	Function
1	INPUT	I	An input coupling capacitor is required. It is biased to VDD/2 internally.
2	NC		
3	PD	I	Powerdown mode is entered by making this pin high.
4	OSC0	O	Connect the 4.194304MHz crystal to these pins to form an oscillator.
5	OSC1	I	
6	NC		
7	Vss		Power supply pin. Normally 0 V
8	LOADB	I	Release
9	SD	O	The decoded DTMF output is output as 4-bit serial data beginning with the LSB.
10	ACK	I	The ACK pin shifts out data to the SD pin.
11	STD	O	High: The DTMF signal is present.
12	EST	O	Release
13	NC		
14	VDD		Power supply pin. Normally 3.3 to 5.5 V

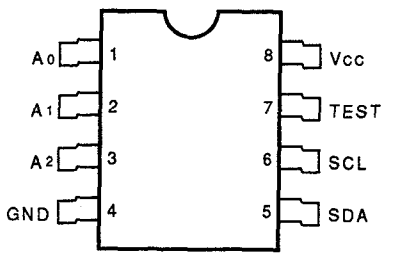
• **Block diagram**



SEMICONDUCTOR DATA

EEPROM for memory : AT24C04N10S12.5 (IC202)

• **Pin connection diagram**



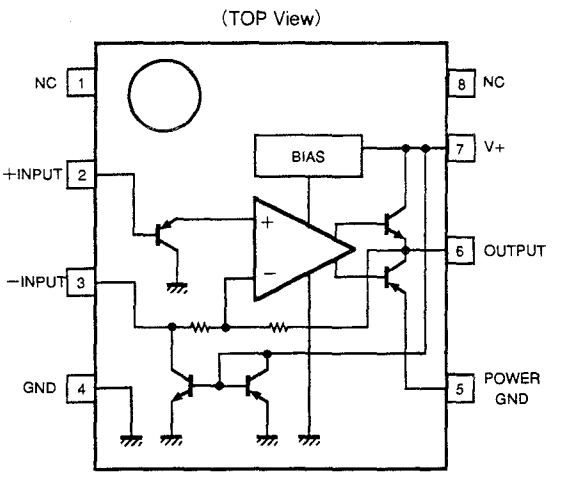
8 pin SOIC

• **Pin function**

Pin name	Function
A0-A1	Address input
SDA	Serial data
SCL	Serial clock
Test	Test input → GND
NC	No connection

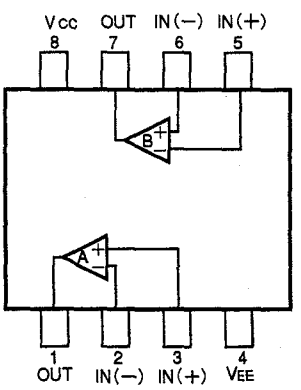
AF power amplifier : NJM2070M (IC208)

• **Block and pin connection diagram**

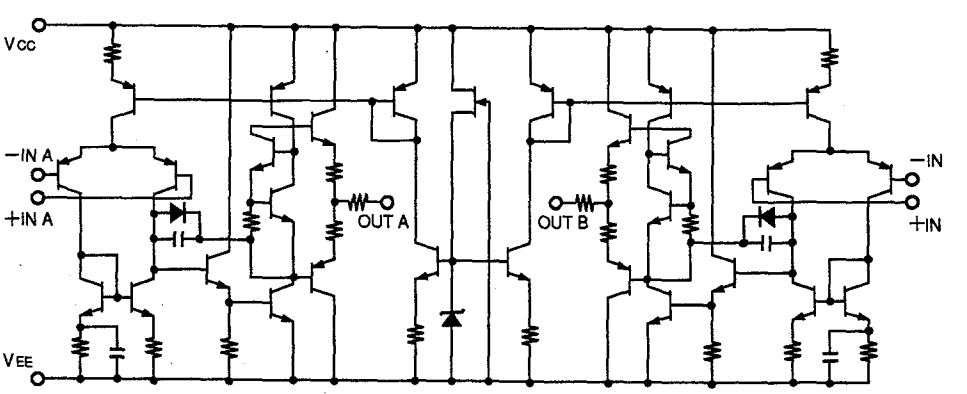


Microphone amplifier : TA75W558FU (IC207)

• **Pin connection diagram**



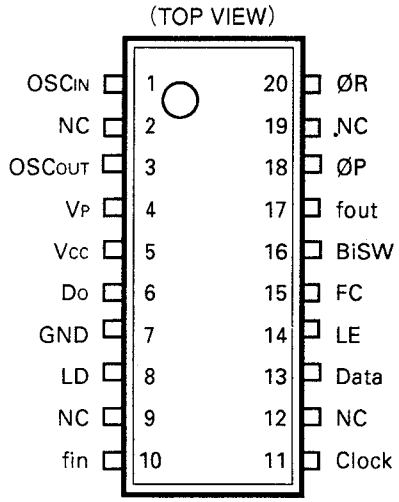
• **Equivalent circuit**



SEMICONDUCTOR DATA

PLL IC: MB1511PFV-G-BND (IC1)

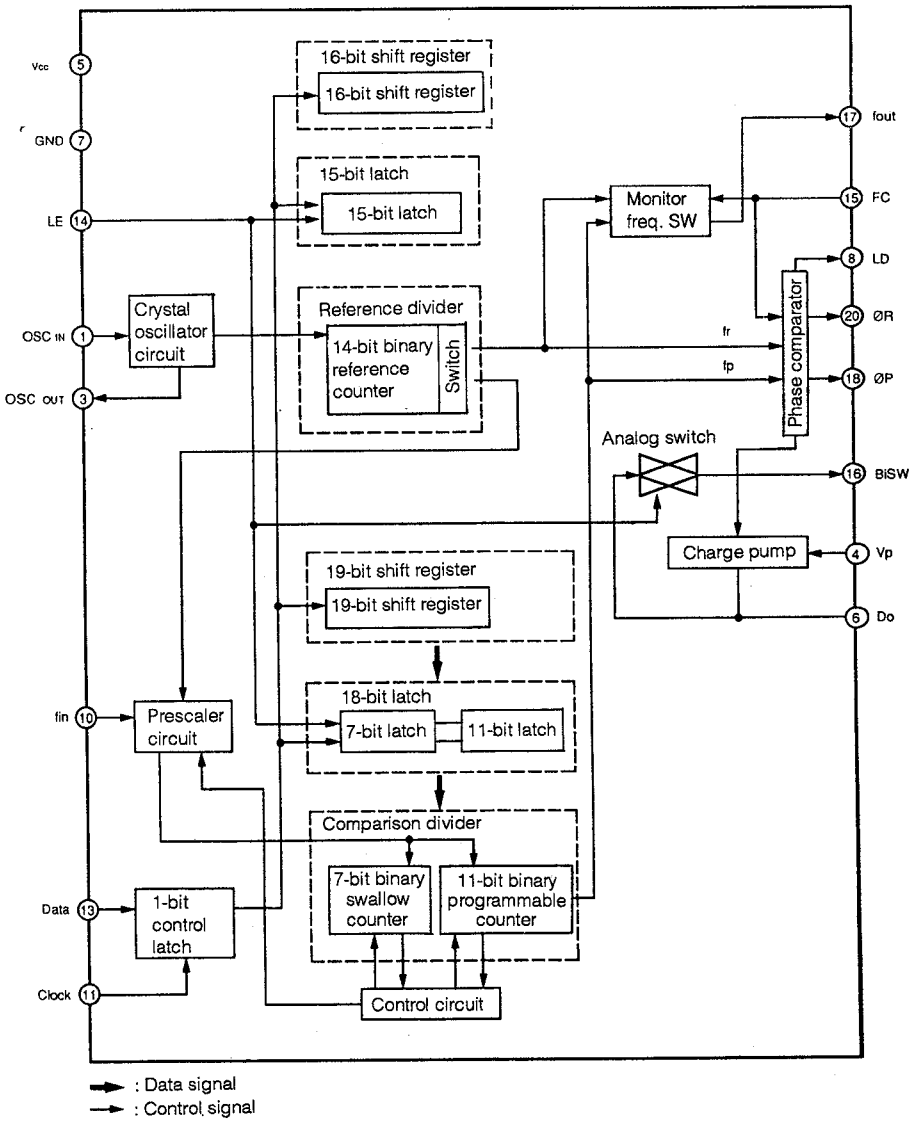
• **Pin connection diagram**



• **Operating conditions**

Item	Code	Standard value			Unit
		Minimum	Standard	Maximum	
Power supply voltage	Vcc	2.7	3.0	5.5	V
	Vp	Vcc	–	8.0	V
Input voltage	VIN	GND	–	Vcc	V
Operating temperature	Ta	−40	–	+85	°C

• **Block diagram**



SEMICONDUCTOR DATA

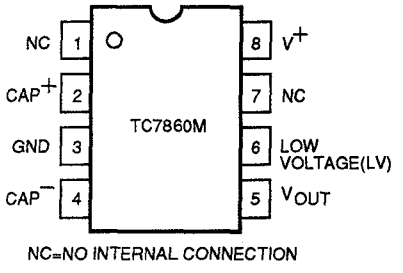
• **Functions of pins**

<table>
<tr><th>Pin No.</th><th>Pin code</th><th>I/O</th><th>Function</th></tr>
<tr><td>1</td><td>OSCIN</td><td>I</td><td rowspan="2">Crystal oscillator connection pin and reference divider input pin
(OSCIN= Oscillator circuit input pin, OSCOUT= Oscillator circuit output pin)</td></tr>
<tr><td>3</td><td>OSCOUT</td><td>O</td></tr>
<tr><td>4</td><td>VP</td><td>–</td><td>Power supply pin for charge pump and analog switch output</td></tr>
<tr><td>5</td><td>Vcc</td><td>–</td><td>Power supply pin</td></tr>
<tr><td>6</td><td>Do</td><td>O</td><td>Built-in charge pump output pin</td></tr>
<tr><td>7</td><td>GND</td><td>–</td><td>GND pin</td></tr>
<tr><td>8</td><td>LD</td><td>O</td><td>Phase comparator output pin. Normally LD is high. LD is low in the period corresponding to the phase difference between fr and fp.</td></tr>
<tr><td>10</td><td>fin</td><td>I</td><td>Prescaler input pin. AC connection</td></tr>
<tr><td>11</td><td>Clock</td><td>I</td><td>Clock input pin for 19 and 16-bit shift registers.
Data is read on the rising edge of the clock pulse.</td></tr>
<tr><td>13</td><td>Data</td><td>I</td><td>Binary code serial data input pin. The last data bit is a control bit.
<table><tr><th>Control data</th><th>Serial data destination</th></tr><tr><td>H</td><td>15 bit latches</td></tr><tr><td>L</td><td>18 bit latches</td></tr></table></td></tr>
<tr><td>14</td><td>LE</td><td>I</td><td>Load enable signal input pin (with pull-up resistor). When LE is high or open, the shift register contents are sent to the latch together with the serial data control bit. The built-in analog switch turns on, and the output signal from the built-in charge pump is sent to the BiSW pin.</td></tr>
<tr><td>15</td><td>FC</td><td>I</td><td>Phase comparator phase switching pin (with pull-up resistor). This reverses the polarity of the phase comparator output according to the polarity of the externally connected LPF and VCO. When FC is low, the characteristics of the charge pump and phase comparator are reversed. It also switches between fout pin (test pin) outputs fr and fp.</td></tr>
<tr><td>16</td><td>BiSW</td><td>O</td><td>Analog switch output pin. Normally high impedance. Only when the switch is on (LE: high), the built-in charge pump state is output.</td></tr>
<tr><td>17</td><td>fout</td><td>O</td><td>Phase comparator input monitor pin. Either the reference divider output (fr) or comparison divider output (fp) signal is output according to the FC pin input level.
<table><tr><th>FC</th><th>Output signal</th></tr><tr><td>H</td><td>fr output</td></tr><tr><td>L</td><td>fp output</td></tr></table></td></tr>
<tr><td>18</td><td>φP</td><td>O</td><td rowspan="2">Phase comparator external charge pump output pin. The phase characteristics are reversed by the FC pin setting.
The φP pin is Nch. open drain output.</td></tr>
<tr><td>20</td><td>φR</td><td>O</td></tr>
<tr><td>2, 9, 12, 19</td><td>NC</td><td>–</td><td>No connection</td></tr>
</table>

SEMICONDUCTOR DATA

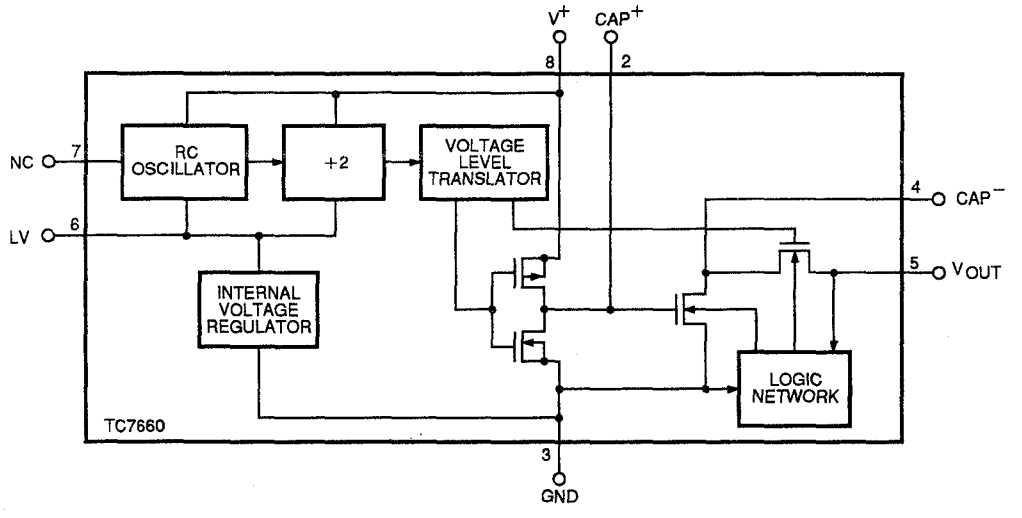
DC・DC convertor : TC7660MEOA (IC2)

• **Pin connection diagram**



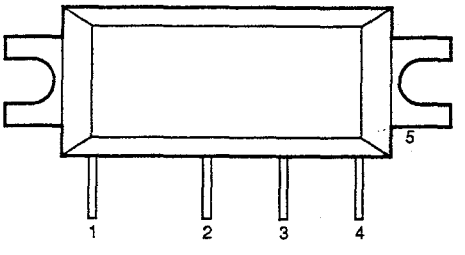
NC=NO INTERNAL CONNECTION

• **Block diagram**



Power module: PF0310-01 (IC3)

• **Pin connection diagram**



Pin assignment
1 : Pin
2 : Vpc
3 : Vdd
4 : Pout
5 : GND(flange)

TH-22A/AT/E

DESCRIPTION OF COMPONENTS

TX-RX unit (X57-437X-XX)
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2

Ref. No.	Use/Function	Operation/Condition/Compatibility
IC1	PLL IC	
IC2	DC-DC converter	About twice the input voltage (3.5 V) is output.
IC3	Transmission power amplifier	
IC4	FM IC	Second mixer, quadrature detector, AF output, noise amplifier output, S-meter output
IC201	DTMF receiver	
IC202	EEPROM	
IC203	3.5V AVR	
IC204	APC comparator	
IC205	Voltage detection	
IC206	Microprocesser	
IC207	Microphone amplifier	Limiter amplifier, active low-pass filter
IC208	AF power amplifier	
IC209	Reset circuit comparator	
Q1	Ripple filter	
Q2	RF amplifier	PLL IC 8-pin IN (fin amplifier)
Q3, Q4	Charge pump	
Q5	DC buffer amplifier	
Q6	RF power amplifier	First stage of driver
Q7	RF power amplifier	Second stage of driver
Q8	First mixer	144MHz band → 45.05MHz band
Q9	RF amplifier	144MHz first stage
Q10	Noise amplifier	
Q11	IF amplifier	MCF post amplifier
Q12	Active high-pass filter	
Q13	Mute switch	Mute switch; "H": Receive audio signal On
Q14	Constant-current circuit	
Q15	Power module protection switch	
Q16	Current limit circuit	
Q201	Transmission power changeover switch	See the circuit description of the APC circuit and transmission changeover circuit.
Q202	DC SW	APC circuit reference voltage equals SB voltage when EL is On.
Q203	APC voltage control circuit	
Q205	Transmission power changeover switch	See the circuit description of the APC circuit and transmission changeover circuit.
Q206	Constant-current circuit	
Q207	APC circuit power supply switch	
Q208	3M SW	3M SW; "L": ON
Q209	Mute switch	Mute switch, "H": Transmission audio signal Off
Q210	AVR	AF amplifier power supply
Q211	Error amplifier	Q13 bias control
Q212	AF amplifier power supply switch	AF amplifier power supply switch, "L": On
Q213	AVR	3T
Q214	AVR	3C

DESCRIPTION OF COMPONENTS

Ref. No.	Use/Function	Operation/Condition/Compatibility
Q215	Differential DC amplifier	Q213 output control
Q216	Differential DC amplifier	Q214 output control
Q217	3T SW	
Q218	3C SW	
Q219	3R SW	3R output control
Q220	Reset circuit	
Q221	Mute switch	Mute switch, "H": Receive audio signal On
D1	Quick charge	3C ripple filter
D3	Waveform shaping	
D4	Startup diode	IC2 voltage generater circuit
D7	DC SW	On in transmit mode
D8	RF SW	On in transmit mode
D9	RF SW	On in transmit mode
D11, D12	Transmission/reception changeover switch	On in transmit mode; Off in receive mode
D13, D14, D15	Receive shift	
D16	Noise rectification	
D17	Reverse-flow prevention	
D18	Constant-voltage circuit	
D20	Power module protection diode	
D202	Constant-voltage circuit	
D204, D205	LED	LAMP
D206-D216	Reverse-flow prevention	
D217	LED	ON AIR
D218	Constant-voltage circuit	AF amplifier power supply
D220	Quick discharge	

VCO unit (X58-4090-00)

Ref. No.	Use/Function	Operation/Condition/Compatibility
Q1	Transmission/reception changeover switch	Transmission/reception changeover switch, "L": Receive frequency
Q2	Oscillation amplifier	
Q3, Q4	Buffer amplifier	
D1, D2	VCO frequency control	
D3	Modulation	
D4	Frequency shift	

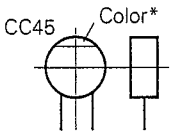
TH-22A/AT/E

PARTS LIST

CAPACITORS

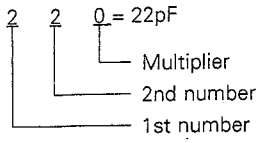
CC 45 TH 1H 220 J
1 2 3 4 5 6

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



• Capacitor value

010 = 1pF
100 = 10pF
101 = 100pF
102 = 1000pF = 0.001µF
103 = 0.01µF



• 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 ± 60ppm/°C

• Tolerance

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

Less than 10pF

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

• Voltage rating

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

• Chip capacitors (Refer to the table above except dimension)

(EX) CC 73 F SL 1H 000 J
1 2 3 4 5 6 7
(Chip) (CH, RH, UJ, SL)

(EX) CK 73 F F 1H 000 Z
1 2 3 4 5 6 7
(Chip) (B, F)

RESISTORS

• Chip resistor (Carbon)

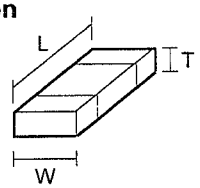
(EX) RD 73 E B 2B 000 J
1 2 3 4 5 6 7
(Chip) (B,F)

• Carbon resistor (Normal type)

(EX) RD 14 B B 2C 000 J
1 2 3 4 5 6 7

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

Dimension



• Dimension (Chip capacitor)

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

• Dimension (Chip resistor)

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

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

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.

TH-22A/AT/E

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-22A/AT/E						
1	3B	*	A01-2081-02	METALLIC CABINET (REAR)		
2	1B	*	A02-1763-03	CASE ASSY (TH-22A)	M1M2M3	
2	1B	*	A02-1763-03	CASE ASSY (TH-22A)	M4M5X	
3	1B	*	A02-1764-03	CASE ASSY (TH-22AT)	KM1M2	
3	1B	*	A02-1764-03	CASE ASSY (TH-22AT)	M3M4P	
4	1B	*	A02-1765-03	CASE ASSY (TH-22E)	TE1E2	
4	1B	*	A02-1765-03	CASE ASSY (TH-22E)	E3E4E9	
5	2B	*	A02-1784-03	BT-9 CASE (FRONT)	M4M5X	
6	3B	*	A02-1785-02	BT-9 CASE (REAR)	M4M5X	
7	3A	*	A62-0277-02	PANEL		
8	-	*	B09-0335-14	CAP (MIC/SP) :ACCY		
9	3A	*	B09-0336-14	CAP (DC IN)		
10	1A	*	B10-1202-03	FRONT GLASS		
11	3A	*	B11-1092-04	FILTER (ON AIR)		
12	1B		B42-3343-04	S/NO LABEL		
-			B42-3394-14	FCC PLATE	K	
-		*	B42-5074-04	LABEL	K	
-			B42-5526-04	FACE PLATE	K	
16	-		B46-0310-03	WARRNTY CARD	E1E2E3	
16	-		B46-0310-03	WARRNTY CARD	E4E9	
17	-		B46-0410-30	WARRNTY CARD	K	
18	-		B46-0422-00	WARRNTY CARD	P	
19	-	*	B62-0364-00	INSTRUCTION MANUAL		
20	-	*	B62-0365-00	INSTRUCTION MANUAL	E1E2	
21	-	*	B62-0366-00	INSTRUCTION MANUAL	M1M2M3	
21	-	*	B62-0366-00	INSTRUCTION MANUAL	M4	
21	-	*	B62-0366-00	INSTRUCTION MANUAL	E3E4E9	
22	3B	*	B72-0553-04	MODEL NAME PLATE (TH-22AT FCC)	KP	
23	3B	*	B72-0554-04	MODEL NAME PLATE (TH-22A)	M1M2M3	
23	3B	*	B72-0554-04	MODEL NAME PLATE (TH-22A)	M4M5X	
24	3B	*	B72-0555-04	MODEL NAME PLATE (TH-22AT)	M1M2M3	
24	3B	*	B72-0555-04	MODEL NAME PLATE (TH-22AT)	M4	
25	3B	*	B72-0556-04	MODEL NAME PLATE (TH-22E)	TE1E2	
25	3B	*	B72-0556-04	MODEL NAME PLATE (TH-22E)	E3E4	
26	2B	*	B72-0572-14	MODEL NAME PLATE (BT-9)	M4M5X	
27	3B		B72-0651-04	MODEL NAME PLATE (FRANCE TA)	E9	
28	3A		E04-0181-05	RF COAXIAL CABLE RECEPTACLE		
29	-		E19-0254-05	AC PLUG :ACCY	M1M2M3	
-		*	E23-0944-04	TERMINAL (BT-9 CASE)	M4M5X	
-		*	E23-0945-04	TERMINAL (BT-9 CASE)	M4M5X	
32	2B	*	E23-0946-04	TERMINAL (BT-9 CASE)	M4M5X	
-		*	E23-0947-04	TERMINAL (BT-9 CASE)	M4M5X	
34	3B	*	E23-0948-04	TERMINAL (BT-9 CASE)	M4M5X	
-		*	E23-0949-04	TERMINAL (BT-9 CASE)	M4M5X	
36	1B	*	F07-1371-13	COVER (DTMF)	M1M2M3	
36	1B	*	F07-1371-13	COVER (DTMF)	M4M5TX	
36	1B	*	F07-1371-13	COVER (DTMF)	E1E2E3	
36	1B	*	F07-1371-13	COVER (DTMF)	E4E9	
37	3A	*	F20-1143-14	INSULATING BOARD (DC IN)		
38	3A		F29-0435-05	INSULATOR (BELT HOOK)		
-			G11-0701-04	SHEET	E9	

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

TH-22A : M1,M2,M3,M4,M5,X
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TH-22E : E1,E2,E3,E4,E9,T

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TH-22A/AT/E

PARTS LIST

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TH-22A/AT/E

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
40	3B	*	G13-1375-04	CUSION (BT-9 CASE)	M4M5X	
41	-	*	H10-2775-02	POLYSTYRENE FOAMED FIXTURE		
42	-		H11-0808-14	POLYSTYRENE FOAMED BOARD	KM5TX	
45	-		H25-0077-03	PROTECTION BAG(10x12:BT-9)	M4M5X	
46	-		H25-0085-04	PROTECTION BAG(10x20)		
47	-	*	H52-0441-04	ITEM CARTON BOX (TH-22A)	M1M2M3	
47	-	*	H52-0441-14	ITEM CARTON BOX (TH-22A)	M4M5X	
48	-	*	H52-0442-14	ITEM CARTON BOX (TH-22AT)	KM1M2	
48	-	*	H52-0442-14	ITEM CARTON BOX (TH-22AT)	M3M4P	
49	-	*	H52-0443-04	ITEM CARTON BOX (TH-22E)	TE1E2	
49	-	*	H52-0443-04	ITEM CARTON BOX (TH-22E)	E3E4E9	
50	-		J29-0465-04	BELT HOOK :ACCY		
51	1A		J39-0441-04	SPACER (MIC)		
52	-	*	J61-0422-05	BAND		
53	-		J69-0327-04	HAND STRAP :ACCY		
54	3A	*	K29-4874-14	KNOB (VOL)		
55	3A	*	K29-4875-14	KNOB (ENCODER)		
56	2B	*	K29-4876-03	KNOB (PTT)		
57	1B	*	K29-4877-04	KNOB (2 KEY)		
58	1A	*	K29-4878-03	KNOB (4 KEY)		
A	3A		N09-2028-05	SCREW (M3x4) (BELT HOOK)		
B	2B		N30-2605-46	PAN HEAD MACHIN SCREW		
C	3A		N30-2606-45	PAN HEAD MACHIN SCREW (BNC)		
D	3B	*	N80-2022-45	PAN HEAD MACHIN SCREW (CASE)		
E	2A		N83-2004-46	PAN HEAD MACHIN SCREW (PCB)		
59	1B	*	S79-0412-05	KEY BOARD ASSY(DTMF:TH-22AT)	KPM1M2	
59	1B	*	S79-0412-05	KEY BOARD ASSY(DTMF:TH-22AT)	M3M4	
SP	1B		T07-0257-05	LOUDSPEAKER(8 ohm 0.5w)		
60	-	*	T90-0472-05	ANTENNA :ACCY		
MIC	1A	*	T91-0539-05	MICROPHONE (ELEMENT)		
68	3B		ERB83-004	DIODE (BT-9 CASE)	M4M5X	
61	-	*	W08-0437-05	BATTERY CHARGER(120V) :ACCY	KP	
62	-	*	W08-0438-05	BATTERY CHARGER(240V) :ACCY	T	
63	-	*	W08-0440-05	BATTERY CHARGER(230V) :ACCY	E1E2E3	
63	-	*	W08-0440-05	BATTERY CHARGER(230V) :ACCY	E4E9	
64	-	*	W08-0441-05	BATTERY CHARGER(120/230V):ACCY	M1M2M3	
65	-	*	W09-0825-05	BATTERY PACK (PB-34:9.6V):ACCY	M3E4	
66	-	*	W09-0826-05	BATTERY PACK (PB-32:6.0V):ACCY	KM1M2	
66	-	*	W09-0826-05	BATTERY PACK (PB-32:6.0V):ACCY	TPE9	
66	-	*	W09-0826-05	BATTERY PACK (PB-32:6.0V):ACCY	E1E2E3	
67	-	*	BT-9	BATTERY CASE :ACCY	XM4M5	
-		*	X57-4370-11	TX-RX UNIT	KP	
-		*	X57-4370-21	TX-RX UNIT	M1	
-		*	X57-4370-22	TX-RX UNIT	M2M3M4	
-		*	X57-4370-23	TX-RX UNIT	M5	
-		*	X57-4370-71	TX-RX UNIT	X	
-		*	X57-4372-71	TX-RX UNIT	TE1E3	

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TH-22A/AT/E
TX-RX UNIT (X57-437X-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
-		*	X57-4372-71	TX-RX UNIT	E4E9	
-		*	X57-4372-72	TX-RX UNIT	E2	
TX-RX UNIT (X57-437X-XX) 0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2						
100	2A	*	A13-1606-13	FRAME		
101	2A	*	B11-1093-13	FILTER (LCD)		
102	2A	*	B11-1094-14	FILTER (LCD)		
C1			C92-0507-05	CHIP TAN 4.7UF 6.3WV		
C2 ,3			CK73GB1H102K	CHIP C 1000PF K		
C4			CC73GCH1H1R5C	CHIP C 1.5PF C		
C6			C92-0507-05	CHIP TAN 4.7UF 6.3WV		
C7			CK73GB1H102K	CHIP C 1000PF K		
C8			CK73FB1E104K	CHIP C 0.10UF K		
C9			CC73GCH1H101J	CHIP C 100PF J		
C10			CC73GCH1H070D	CHIP C 7PF D		
C13			CC73GCH1H220J	CHIP C 22PF J		
C14			CK73FB1E473K	CHIP C 0.047UF K		
C15			CK73GR1C333K	CHIP C 0.033UF K		
C16			C92-0543-05	CHIP TAN 3.3UF 10WV		
C17			CC73GCH1H101J	CHIP C 100PF J		
C18			C92-0001-05	CHIP TAN 0.1UF 35WV		
C19 ,20		*	C92-0565-05	TANTAL 6.8UF 10WV		
C21 ,22			CK73GB1E103K	CHIP C 0.010UF K		
C24			CC73GCH1H390J	CHIP C 39PF J		
C26 ,27			CK73GB1H102K	CHIP C 1000PF K		
C28			CC73GCH1H220J	CHIP C 22PF J		
C29 -31			CK73GB1H102K	CHIP C 1000PF K		
C32			CC73GCH1H330J	CHIP C 33PF J		
C34			CK73GB1H102K	CHIP C 1000PF K		
C36			CK73GB1E103K	CHIP C 0.010UF K		
C37			CK73FB1E104K	CHIP C 0.10UF K		
C38			CK73GB1H102K	CHIP C 1000PF K		
C39			CK73GB1E103K	CHIP C 0.010UF K		
C40			CK73FB1E104K	CHIP C 0.10UF K		
C41			CK73GB1H102K	CHIP C 1000PF K		
C42			CC73GCH1H120J	CHIP C 12PF J		
C43			CC73GCH1H180J	CHIP C 18PF J		
C44			CK73GB1H102K	CHIP C 1000PF K		
C46 ,47			CC73GCH1H150J	CHIP C 15PF J		
C49			CK73GB1E103K	CHIP C 0.010UF K		
C50			CC73GCH1H120J	CHIP C 12PF J		
C51			CK73GB1H102K	CHIP C 1000PF K		
C52			CK73GB1E103K	CHIP C 0.010UF K		
C53			CC73GCH1H010C	CHIP C 1PF C		
C54			CC73GCH1H470J	CHIP C 47PF J		
C55			CK73GB1H471K	CHIP C 470PF K		
C56			CK73GB1H102K	CHIP C 1000PF K		
C58			CC73GCH1H270J	CHIP C 27PF J		
C59			CK73GB1H102K	CHIP C 1000PF K		
C61			CC73GCH1H330J	CHIP C 33PF J		
C62 ,63			CK73GB1H102K	CHIP C 1000PF K		
C64			CC73GCH1H560J	CHIP C 56PF J		
C65			CC73GCH1H010C	CHIP C 1PF C		
C67			CK73GB1H102K	CHIP C 1000PF K		

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TH-22A/AT/E

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TX-RX UNIT (X57-437X-XX)

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C68 ,69			CK73GB1E103K	CHIP C	0.010UF	K		
C70			C92-0005-05	ELECTRO	2.2UF	6.3WV		
C71			CK73FB1E104K	CHIP C	0.10UF	K		
C72			CK73GB1E103K	CHIP C	0.010UF	K		
C74			CK73GB1H332K	CHIP C	3300PF	K		
C76 ,77		*	CK73GB1E123K	CHIP C	0.012UF	K		
C79			CK73GB1E103K	CHIP C	0.010UF	K		
C80			C92-0005-05	ELECTRO	2.2UF	6.3WV		
C81			CK73FB1E473K	CHIP C	0.047UF	K		
C82			CK73GB1H472K	CHIP C	4700PF	K		
C83			CK73GB1H102K	CHIP C	1000PF	K		
C84			CK73GR1C333K	CHIP C	0.033UF	K		
C85			CK73GB1E103K	CHIP C	0.010UF	K		
C86			CK73GB1H102K	CHIP C	1000PF	K		
C87 ,88			CK73GB1H391K	CHIP C	390PF	K		
C89			CK73GB1H102K	CHIP C	1000PF	K		
C90			CC73GCH1H080D	CHIP C	8PF	D		
C91			CK73FB1E104K	CHIP C	0.10UF	K		
C92			CK73GB1E103K	CHIP C	0.010UF	K		
C94			CK73GB1E103K	CHIP C	0.010UF	K		
C96			CC73GCH1H270J	CHIP C	27PF	J		
C97			CC73GCH1H150J	CHIP C	15PF	J		
C98			CK73GB1E103K	CHIP C	0.010UF	K		
C99			CK73FB1E104K	CHIP C	0.10UF	K		
C100			CC73GCH1H270J	CHIP C	27PF	J		
C101			CK73FB1E104K	CHIP C	0.10UF	K		
C102			CK73GB1E103K	CHIP C	0.010UF	K		
C103			CK73FB1E104K	CHIP C	0.10UF	K		
C104			CC73GCH1H270J	CHIP C	27PF	J		
C105			CC73GCH1H121J	CHIP C	120PF	J		
C106			CK73FB1H393K	CHIP C	0.039UF	K		
C107			CK73GB1H102K	CHIP C	1000PF	K		
C110			CK73GB1H102K	CHIP C	1000PF	K		
C111		*	C92-0585-05	TANTAL	4.7UF	16WV		
C112		*	C92-0566-05	TANTAL	10UF	6.3WV		
C113			CK73FB1E104K	CHIP C	0.10UF	K		
C114,115			CK73GB1H102K	CHIP C	1000PF	K		
C116			CC73GCH1H010C	CHIP C	1PF	C		
C118			CK73GB1H102K	CHIP C	1000PF	K		
C201			CK73GR1C473K	CHIP C	0.047UF	K		
C202,203			CC73GCH1H390J	CHIP C	39PF	J		
C204		*	C92-0561-05	ELECTRO	22UF	16WV		
C205-207			CK73GB1H471K	CHIP C	470PF	K		
C208		*	C90-4017-05	ELECTRO	470UF	4WV		
C209			CK73FB1E104K	CHIP C	0.10UF	K		
C210,211			CK73GB1H471K	CHIP C	470PF	K		
C212			CC73GCH1H151J	CHIP C	150PF	J		
C213,214			CK73GB1H471K	CHIP C	470PF	K		
C216,217			CK73GB1H471K	CHIP C	470PF	K		
C219			CK73GR1C473K	CHIP C	0.047UF	K		
C220			CK73GB1H103K	CHIP C	0.01UF	K		
C221			CC73GCH1H430J	CHIP C	43PF	J		
C222			CC73GCH1H390J	CHIP C	39PF	J		
C223,224			CK73FB1E104K	CHIP C	0.10UF	K		
C225			CK73GB1E183K	CHIP C	0.018UF	K		

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TX-RX UNIT (X57-437X-XX)

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C226			CK73GB1H103K	CHIP C 0.01UF K		
C227			CK73GB1H472K	CHIP C 4700PF K	KXE1E2	
C227			CK73GB1H472K	CHIP C 4700PF K	M1M2M4	
C228			CK73GB1H471K	CHIP C 470PF K		
C229			C92-0507-05	CHIP TAN 4.7UF 6.3WV		
C230			CK73GB1H103K	CHIP C 0.01UF K		
C231,232			CK73GB1H471K	CHIP C 470PF K		
C233			CC73GCH1H151J	CHIP C 150PF J		
C234			CK73GB1H182K	CHIP C 1800PF K		
C235			CK73GB1E223K	CHIP C 0.022UF K		
C236			C92-0002-05	CHIP TAN 0.22UF 35WV		
C237,238			CK73GB1H103K	CHIP C 0.01UF K		
C239,240		*	C92-0587-05	TANTAL 2.2UF 4WV		
C241			C92-0507-05	CHIP TAN 4.7UF 6.3WV		
C242			CK73FB1H102K	CHIP C 1000PF K		
C243		*	C92-0593-05	ELECTRO 33UF 10WV		
C244			CK73GB1H102K	CHIP C 1000PF K		
C245			C92-0567-05	TANTAL 68UF 6.3WV		
C246			CK73GR1C473K	CHIP C 0.047UF K		
C247		*	C92-0566-05	TANTAL 10UF 6.3WV		
C248			CK73GB1E223K	CHIP C 0.022UF K		
C249			CK73GB1H102K	CHIP C 1000PF K		
C250		*	C92-0587-05	TANTAL 2.2UF 4WV		
C251			CK73GB1H471K	CHIP C 470PF K		
C252		*	C92-0564-05	ELECTRO 22UF 6.3WV		
C253		*	C92-0587-05	TANTAL 2.2UF 4WV		
C254,255			CK73GB1H471K	CHIP C 470PF K		
C256		*	C92-0564-05	ELECTRO 22UF 6.3WV		
C257			CK73GB1H471K	CHIP C 470PF K		
C258		*	C92-0576-05	TANTAL 1UF 6.3WV		
C259			CK73GB1H471K	CHIP C 470PF K		
C265			CK73FB1E104K	CHIP C 0.10UF K		
C267			CK73GR1C333K	CHIP C 0.033UF K		
C268		*	C92-0576-05	TANTAL 1UF 6.3WV		
C270			CK73GB1H103K	CHIP C 0.01UF K		
C274-276			CK73GB1H471K	CHIP C 470PF K		
TC1		*	C05-0380-05	TRIMMER CAPACITOR 10PF		
-		*	E23-0943-04	DC TERMINAL		
104	2A	*	E29-1118-04	CONNECTOR		
105	2A	*	E29-1119-24	CONNECTOR		
106	2A	*	E37-0395-05	FLAT CABLE		
CN1		*	E40-5651-05	FLAT CABLE CONNECTOR (23P)		
CN2		*	E23-0950-04	GND TERMINAL		
CN3			E23-0603-05	TERMINAL		
CN201		*	E40-5629-05	PIN CONNECTOR (6P:PTT)		
CN202		*	E40-5644-05	PIN CONNECTOR (8P:10KEY)		
CN203		*	E40-5651-05	FLAT CABLE CONNECTOR (23P)		
CN204		*	E40-5618-05	FLAT CABLE CONNECTOR(8P:CTCSS)		
CN301		*	E40-5630-05	PIN CONNECTOR (6P:PTT)		
J1			E03-0170-05	DC JACK		
J201		*	E11-0457-05	PHONE JACK		
107	2B	*	G11-0707-04	SHEET (VCO)		
108	2B	*	J19-1546-03	HOLDER		

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TH-22A/AT/E

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TX-RX UNIT (X57-437X-XX)

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109	1A	*	J21-4443-13	HARDWARE FIXTURE (LCD)		
A4 ,5			J30-0545-05	SPACER		
CD1			L79-1013-05	CRYSTAL DISC (455KHZ)		
CF1			L72-0362-05	CERAMIC FILTER (455KHz)		
L1		*	L40-6872-35	SMALL FIXED INDUCTOR		
L2		*	L40-8272-35	SMALL FIXED INDUCTOR (82NH)		
L3		*	L92-0137-05	CHIP CORE		
L4			L40-1095-34	SMALL FIXED INDUCTOR (1UH)		
L5		*	L40-2771-36	SMALL FIXED INDUCTOR (27NH)		
L6			L34-1327-05	COIL (7.5T)		
L7		*	L33-0765-05	CHOKE COIL (50NH)		
L8			L40-1092-81	SMALL FIXED INDUCTOR		
L10			L40-8281-34	SMALL FIXED INDUCTOR (820NH)		
L11			L34-4249-05	COIL		
L12			L34-4248-05	COIL		
L13			L34-4247-05	COIL		
L14		*	L92-0138-05	CHIP CORE		
L15		*	L40-2785-48	SMALL FIXED INDUCTOR (270NH)	M1M2M3	
L15		*	L40-2785-48	SMALL FIXED INDUCTOR (270NH)	M4	
L16 -18		*	L92-0138-05	CHIP CORE		
L19		*	L92-0137-05	CHIP CORE		
L20			L40-1095-34	SMALL FIXED INDUCTOR (1UH)		
L21		*	L79-1076-05	FILTER		
L22			L40-1085-34	SMALL FIXED INDUCTOR (100NH)		
L201-203		*	L92-0138-05	CHIP CORE		
L204			L33-0737-05	CHOKE COIL		
L205-207		*	L92-0138-05	CHIP CORE		
X1		*	L77-1528-05	CRYSTAL RESONATOR(12.8MHz)		
X2		*	L77-1527-15	CRYSTAL RESONATOR(44.595MHz)		
X201		*	L78-0326-05	RESONATOR (4.19MHz)		
X202		*	L78-0325-05	RESONATOR (2.0MHz)		
XF1			L71-0409-05	MCF (45.050MHz)		
CP1			R90-0714-05	MULTI-COMP 10KX4		
CP2			R90-0723-05	MULTI COMP 47x2		
CP201			R90-0720-05	MULTI COMP 100Kx4		
CP202			R90-0724-05	MULTI COMP 1Kx4		
CP203			R90-0725-05	MULTI COMP 1Kx2		
CP204			R90-0724-05	MULTI COMP 1Kx4		
CP205			R90-0725-05	MULTI COMP 1Kx2		
CP206			R90-0724-05	MULTI COMP 1Kx4		
CP207,208			R90-0722-05	MULTI COMP		
R1			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R2			RK73GB1J391J	CHIP R 390 J 1/16W		
R3			RK73GB1J123J	CHIP R 12K J 1/16W		
R4			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R6			RK73GB1J563J	CHIP R 56K J 1/16W		
R7			RK73GB1J104J	CHIP R 100K J 1/16W		
R8 ,9			R92-1252-05	CHIP R 0 OHM		
R10			RK73GB1J100J	CHIP R 10 J 1/16W		
R11			RK73GB1J154J	CHIP R 150K J 1/16W		
R12			RK73GB1J223J	CHIP R 22K J 1/16W		
R13 ,14			RK73GB1J183J	CHIP R 18K J 1/16W		
R15			RK73GB1J103J	CHIP R 10K J 1/16W		
R16			RK73GB1J473J	CHIP R 47K J 1/16W		

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TX-RX UNIT (X57-437X-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
R17			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R18			RK73GB1J272J	CHIP R 2.7K J 1/16W		
R19			RK73GB1J182J	CHIP R 1.8K J 1/16W		
R20			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R22			RK73GB1J101J	CHIP R 100 J 1/16W		
R23			RK73GB1J104J	CHIP R 100K J 1/16W		
R24			RK73GB1J105J	CHIP R 1.0M J 1/16W		
R25 ,26			R92-1252-05	CHIP R 0 OHM		
R27			RK73GB1J101J	CHIP R 100 J 1/16W		
R28			RK73GB1J103J	CHIP R 10K J 1/16W		
R29 ,30			RK73GB1J272J	CHIP R 2.7K J 1/16W		
R31			RK73GB1J820J	CHIP R 82 J 1/16W		
R32			RK73GB1J331J	CHIP R 330 J 1/16W		
R33			RK73GB1J220J	CHIP R 22 J 1/16W		
R34			R92-1252-05	CHIP R 0 OHM		
R36			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R37			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R38			RK73GB1J330J	CHIP R 33 J 1/16W		
R39			RK73GB1J471J	CHIP R 470 J 1/16W		
R40			RK73GB1J561J	CHIP R 560 J 1/16W		
R41			RK73GB1J180J	CHIP R 18 J 1/16W		
R42 ,43			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R44			R92-1252-05	CHIP R 0 ohm J 1/16W		
R46			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R47			RK73FB2A820J	CHIP R 82 J 1/10W		
R48			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R49			RK73GB1J330J	CHIP R 33 J 1/16W		
R50 ,51			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R52			RK73GB1J181J	CHIP R 180 J 1/16W		
R53			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R54			RK73GB1J104J	CHIP R 100K J 1/16W		
R56			RK73GB1J470J	CHIP R 47 J 1/16W		
R57			RK73GB1J272J	CHIP R 2.7K J 1/16W		
R58			RK73GB1J104J	CHIP R 100K J 1/16W		
R59			RK73GB1J330J	CHIP R 33 J 1/16W		
R60			RK73GB1J104J	CHIP R 100K J 1/16W		
R61 -63		*	RK73EB2ER39K	CHIP R 0.39 K 1/4W		
R64			RK73GB1J471J	CHIP R 470 J 1/16W		
R65			R92-1252-05	CHIP R 0 OHM		
R66			RK73GB1J274J	CHIP R 270K J 1/16W		
R67			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R68			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R69			RK73GB1J392J	CHIP R 3.9K J 1/16W		
R70			RK73GB1J103J	CHIP R 10K J 1/16W		
R71			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R72			RK73FB2A120J	CHIP R 12 J 1/10W		
R73			RK73GB1J103J	CHIP R 10K J 1/16W		
R74			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R76			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R77			RK73GB1J274J	CHIP R 270K J 1/16W		
R78			RK73GB1J561J	CHIP R 560 J 1/16W		
R79			RK73GB1J224J	CHIP R 220K J 1/16W		
R80			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R81			RK73GB1J681J	CHIP R 680 J 1/16W		
R82			RK73GB1J472J	CHIP R 4.7K J 1/16W		

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TH-22A : M1,M2,M3,M4,M5,X
TH-22AT : K,M1,M2,M3,M4,P
TH-22E : E1,E2,E3,E4,E9,T

⚠ indicates safety critical components.

TH-22A/AT/E

PARTS LIST

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TX-RX UNIT (X57-437X-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
R83			RK73GB1J683J	CHIP R 68K J 1/16W		
R84			RK73GB1J681J	CHIP R 680 J 1/16W		
R86			RK73GB1J154J	CHIP R 150K J 1/16W		
R87			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R88			RK73GB1J103J	CHIP R 10K J 1/16W		
R89 ,90			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R91			RK73GB1J473J	CHIP R 47K J 1/16W		
R92			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R93			RK73GB1J820J	CHIP R 82 J 1/16W		
R94			RK73GB1J681J	CHIP R 680 J 1/16W		
R98			R92-1252-05	CHIP R 0 ΩHM		
R100			R92-1252-05	CHIP R 0 ΩHM		
R101			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R201			RK73GB1J473J	CHIP R 47K J 1/16W		
R202			RK73GB1J103J	CHIP R 10K J 1/16W		
R203			RK73GB1J331J	CHIP R 330 J 1/16W		
R204,205			RK73GB1J100J	CHIP R 10 J 1/16W		
R206			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R207			RK73GB1J124J	CHIP R 120K J 1/16W		
R208			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R209			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R210			RK73GB1J270J	CHIP R 27 J 1/16W		
R211			RK73GB1J560J	CHIP R 56 J 1/16W		
R212			RK73GB1J682J	CHIP R 6.8K J 1/16W		
R213			RK73GB1J105J	CHIP R 1M J 1/16W		
R215			RK73GB1J223J	CHIP R 22K J 1/16W		
R216		*	RK73GB1J563G	CHIP R 56K G 1/16W		
R217		*	RK73GB1J224G	CHIP R 220K G 1/16W		
R218			RK73GB1J105J	CHIP R 1.0M J 1/16W		
R219			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R220			R92-1252-05	CHIP R 0 ohm J 1/16W		
R221			RK73GB1J100J	CHIP R 10 J 1/16W		
R222			RK73GB1J103J	CHIP R 10K J 1/16W		
R223			RK73GB1J100J	CHIP R 10 J 1/16W		
R224			RK73GB1J103J	CHIP R 10K J 1/16W		
R225,226			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R228			RK73GB1J683J	CHIP R 68K J 1/16W		
R229			RK73GB1J153J	CHIP R 15K J 1/16W		
R230			RK73GB1J823J	CHIP R 82K J 1/16W		
R231			RK73GB1J473J	CHIP R 47K J 1/16W		
R232			RK73GB1J224J	CHIP R 220K J 1/16W		
R234			RK73GB1J822J	CHIP R 8.2K J 1/16W		
R235			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R236,237			RK73GB1J104J	CHIP R 100K J 1/16W		
R238			RK73GB1J823J	CHIP R 82K J 1/16W		
R239			RK73GB1J391J	CHIP R 390 J 1/16W		
R240			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R241			RK73GB1J223J	CHIP R 22K J 1/16W		
R242			RK73GB1J563J	CHIP R 56K J 1/16W		
R243			RK73GB1J473J	CHIP R 47K J 1/16W		
R244			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R245			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R246			RK73GB1J100J	CHIP R 10 J 1/16W		
R247			RK73GB1J101J	CHIP R 100 J 1/16W		
R248			RK73GB1J471J	CHIP R 470 J 1/16W		

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TH-22AT : K,M1,M2,M3,M4,P
TH-22E : E1,E2,E3,E4,E9,T

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PARTS LIST

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TX-RX UNIT (X57-437X-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
R249			RK73GB1J182J	CHIP R 1.8K J 1/16W		
R250			RK73FB2A101J	CHIP R 100 J 1/10W		
R251			RK73GB1J101J	CHIP R 100 J 1/16W		
R252			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R253			RK73GB1J331J	CHIP R 330 J 1/16W		
R254			RK73GB1J182J	CHIP R 1.8K J 1/16W		
R255			RK73GB1J103J	CHIP R 10K J 1/16W		
R256			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R257			RK73GB1J103J	CHIP R 10K J 1/16W		
R258			RK73GB1J153J	CHIP R 15K J 1/16W		
R259			RK73GB1J100J	CHIP R 10 J 1/16W		
R260			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R261			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R262			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R263			RK73GB1J683J	CHIP R 68K J 1/16W		
R264			RK73GB1J272J	CHIP R 2.7K J 1/16W		
R265			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R266			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R267			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R268			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R269			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R270,271			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R272			RK73GB1J473J	CHIP R 47K J 1/16W		
R273			RK73GB1J103J	CHIP R 10K J 1/16W		
R274			RK73GB1J473J	CHIP R 47K J 1/16W		
R275			RK73GB1J273J	CHIP R 27K J 1/16W		
R276			RK73GB1J103J	CHIP R 10K J 1/16W		
R277			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R278,279			RK73GB1J104J	CHIP R 100K J 1/16W		
R280			RK73GB1J100J	CHIP R 10 J 1/16W		
R287			RK73GB1J473J	CHIP R 47K J 1/16W		
R289			RK73GB1J474J	CHIP R 470K J 1/16W		
R290			RK73GB1J100J	CHIP R 10 J 1/16W		
R293			RK73GB1J104J	CHIP R 100K J 1/16W		
R294			RK73GB1J103J	CHIP R 10K J 1/16W		
R296			RK73GB1J473J	CHIP R 47K J 1/16W		
R297,298			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R400			R92-1252-05	CHIP R 0 ΩHM		
R401			R92-0670-05	CHIP R 0 ΩHM		
R402			RK73GB1J222J	CHIP R 2.2K J 1/16W		
VR1		*	R05-3469-05	PΩTENTIΩMETER 10K		
VR2			R12-6717-05	TRIM PΩT 47K		
VR201		*	R12-7478-05	TRIM PΩT 470		
VR202		*	R12-7486-05	TRIM PΩT 10K		
S301			S40-1117-05	TACT SWITCH		
LCD	2A	*	B38-0703-05	LCD		
D1		*	MA2S111	DIΩDE		
D3		*	MA2S111	DIΩDE		
D4			MA728	DIΩDE		
D5			DA221	DIΩDE		
D7			MA110	DIΩDE		
D8 ,9			MA77	DIΩDE		
D11			MI809	DIΩRD		
D12			1SS312	DIΩDE		

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TH-22E : E1,E2,E3,E4,E9,T

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TH-22A/AT/E

PARTS LIST

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TX-RX UNIT (X57-437X-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
D13 -15		*	HVU355	DIODE		
D16			MA742	DIODE		
D17		*	SFPB-72VL	DIODE		
D18			DA221	DIODE		
D20			MA8062	DIODE		
D202			MA8039	DIODE		
D204,205		*	B30-2116-05	LED		
D206.207			MA110	DIODE		
D208			MA110	DIODE	KXE1	
D208			MA110	DIODE	M1M3	
D209			MA110	DIODE	KXE1E2	
D210,211			MA110	DIODE		
D212			MA110	DIODE	XE1E2	
D212			MA110	DIODE	M1M2M4	
D213			MA110	DIODE	E1E2M1	
D213			MA110	DIODE	M2M3M4	
D215			HN2D01FU	DIODE		
D216		*	MA2S111	DIODE		
D217		*	B30-2115-05	LED		
D218			DTZ3.9(B)	DIODE		
D220		*	MA2S111	DIODE		
IC1			MB1511PFV-G-BND	IC(PLL FREQUENCY SYNTHESIZER)		
IC2		*	TC7660MEOA	IC		
IC3		*	PF0310-01	IC(POWER MODULE)		
IC4		*	MC3372V	IC		
IC201		*	LC7387M-L	IC		
IC202		*	AT24C04N10SI2.5	IC		
IC203		*	S-81235PG-PI	IC		
IC204			LM301AD	IC(OP AMP)		
IC205		*	S-80730SN-DT	IC		
IC206		*	HD404629B17TF	IC(MPU)		
IC207		*	TA75W558FU	IC		
IC208		*	NJM2070M	IC(AF AMP)		
IC209		*	TC7S08FU	IC		
Q1			2SC4738(GR)	TRANSISTOR		
Q2			2SC4619	TRANSISTOR		
Q3			2SJ243	FET		
Q4			2SK1824	FET		
Q5			2SK879(Y)	FET		
Q6			2SC4083(N,P)	TRANSISTOR		
Q7			2SC4093	TRANSISTOR		
Q8		*	2SC4808(Q)	TRANSISTOR		
Q9		*	2SK1215(E)	FET		
Q10			2SC4738(GR)	TRANSISTOR		
Q11			2SC4619	TRANSISTOR		
Q12			2SC4738(GR)	TRANSISTOR		
Q13			2SK1824	FET		
Q14		*	2SD1483	TRANSISTOR		
Q15			2SC4738(GR)	TRANSISTOR		
Q16			2SK879(GR)	FET		
Q201			2SK1824	FET		
Q202			2SJ243	FET		
Q203			DTA114EU	DIGITAL TRANSISTOR		
Q205			UMC4	DIGITAL TRANSISTOR		
Q206			2SK879(Y)	FET		

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TX-RX UNIT (X57-437X-XX)
VCO UNIT (X57-4090-00)

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
Q207			DTC114YE	DIGITAL TRANSISTOR		
Q208			DTA143ZE	DIGITAL TRANSISTOR		
Q209			2SK1824	FET		
Q210			2SB766(R,S)	TRANSISTOR		
Q211			2SC4738(GR)	TRANSISTOR		
Q212			DTA144EE	DIGITAL TRANSISTOR		
Q213,214			2SB766(R,S)	TRANSISTOR		
Q215,216			UMW1	DIGITAL TRANSISTOR		
Q217,218			2SK1824	FET		
Q219			DTA143ZE	DIGITAL TRANSISTOR		
Q220			2SJ243	FET		
Q221			2SK1588	FET		
TH1		*	157-502-65001	THERMISTOR		
TH201		*	157-503-65001	THERMISTOR		
A1		*	X58-4090-00	SUB UNIT (VCO)		
S1		*	W02-1795-05	ENCODER		
VCO UNIT (X57-4090-00)						
C1 ,2			CK73HB1E102K	CHIP C 1000PF K		
C3			CC73GUJ1H010C	CHIP C 1PF C		
C4 ,5			CK73HB1E102K	CHIP C 1000PF K		
C7		*	CC73HCH1E040C	CHIP C 4PF C		
C8		*	C93-0544-05	CHIP C 2PF		
C9			CK73HB1E102K	CHIP C 1000PF K		
C10		*	CC73HCH1E010C	CHIP C 1PF C		
C11			CK73HB1E102K	CHIP C 1000PF K		
C12 ,13		*	CC73HCH1E100D	CHIP C 10PF D		
C14		*	C93-0542-05	CHIP C 1PF		
C17		*	CC73HCH1E100D	CHIP C 10PF D		
CN1 ,2		*	E40-5622-05	PIN CONNECTOR (3P)		
L1		*	L33-0797-05	CHOKE COIL (39NH)		
L2		*	L33-0796-05	CHOKE COIL (33NH)		
L3			L40-1092-34	SMALL FIXED INDUCTOR		
R1		*	RK73HB1J332J	CHIP R 3.3K J 1/16W		
R2		*	RK73HB1J104J	CHIP R 100K J 1/16W		
R3			RK73HB1J473J	CHIP R 47K J 1/16W		
R4		*	RK73HB1J102J	CHIP R 1K J 1/16W		
R5			RK73HB1J561J	CHIP R 560 J 1/16W		
R6		*	RK73HB1J220J	CHIP R 22 J 1/16W		
R7			RK73HB1J270J	CHIP R 27 J 1/16W		
R8			RK73HB1J823J	CHIP R 82K J 1/16W		
R9			RK73HB1J561J	CHIP R 560 J 1/16W		
R10			RK73HB1J823J	CHIP R 82K J 1/16W		
R11			RK73HB1J561J	CHIP R 560 J 1/16W		
R12			R92-1252-05	CHIP R 0 OHM		
D1 ,2		*	MA362*J	DIODE		
D3			MA360	DIODE		
D4			MA77	DIODE		
Q1			DTC144EE	DIGITAL TRANSISTOR		
Q2			2SK238(K17)	FET		
Q3 ,4		*	2SC4808(Q)	TRANSISTOR		

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TH-22E : E1,E2,E3,E4,E9,T

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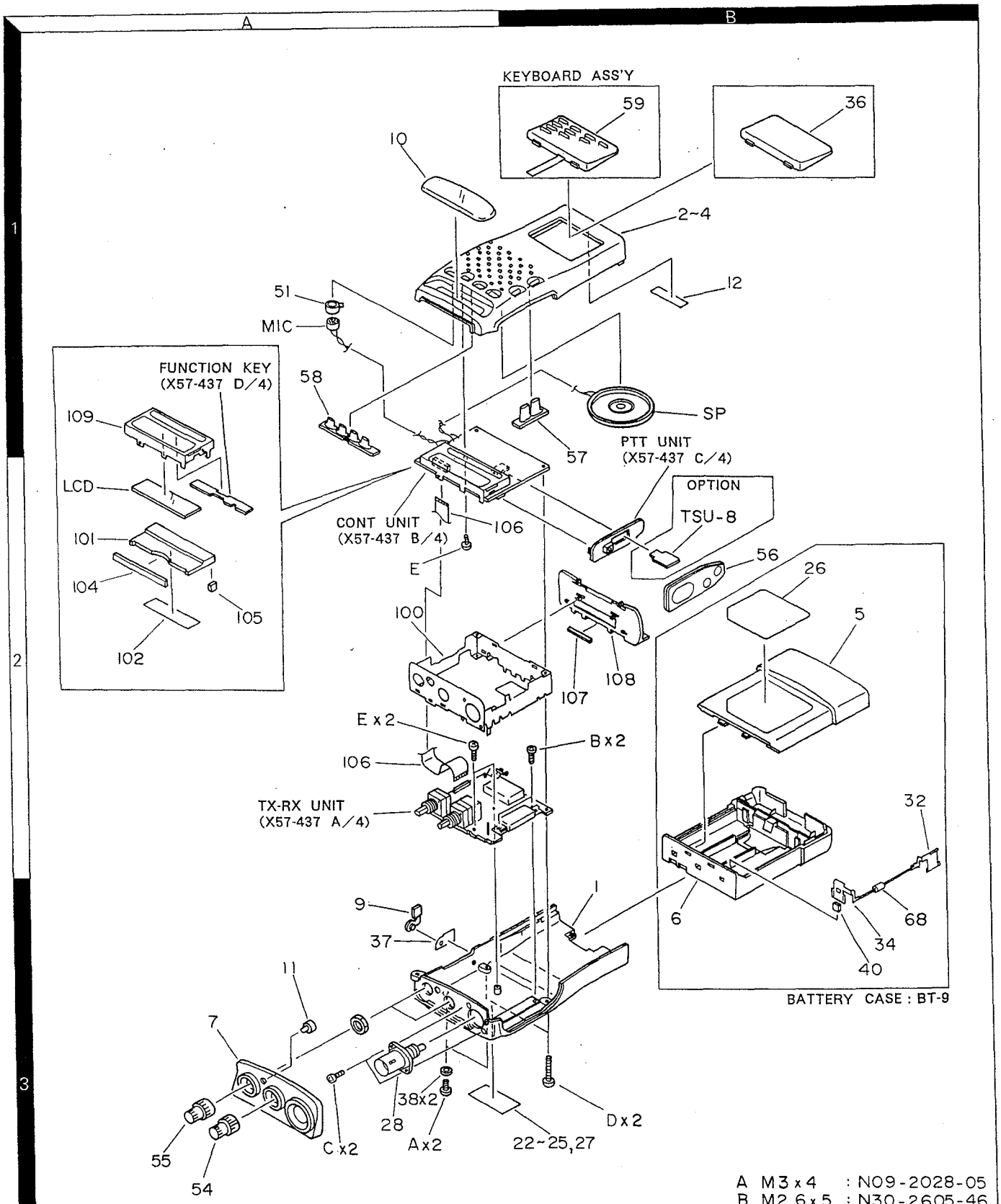
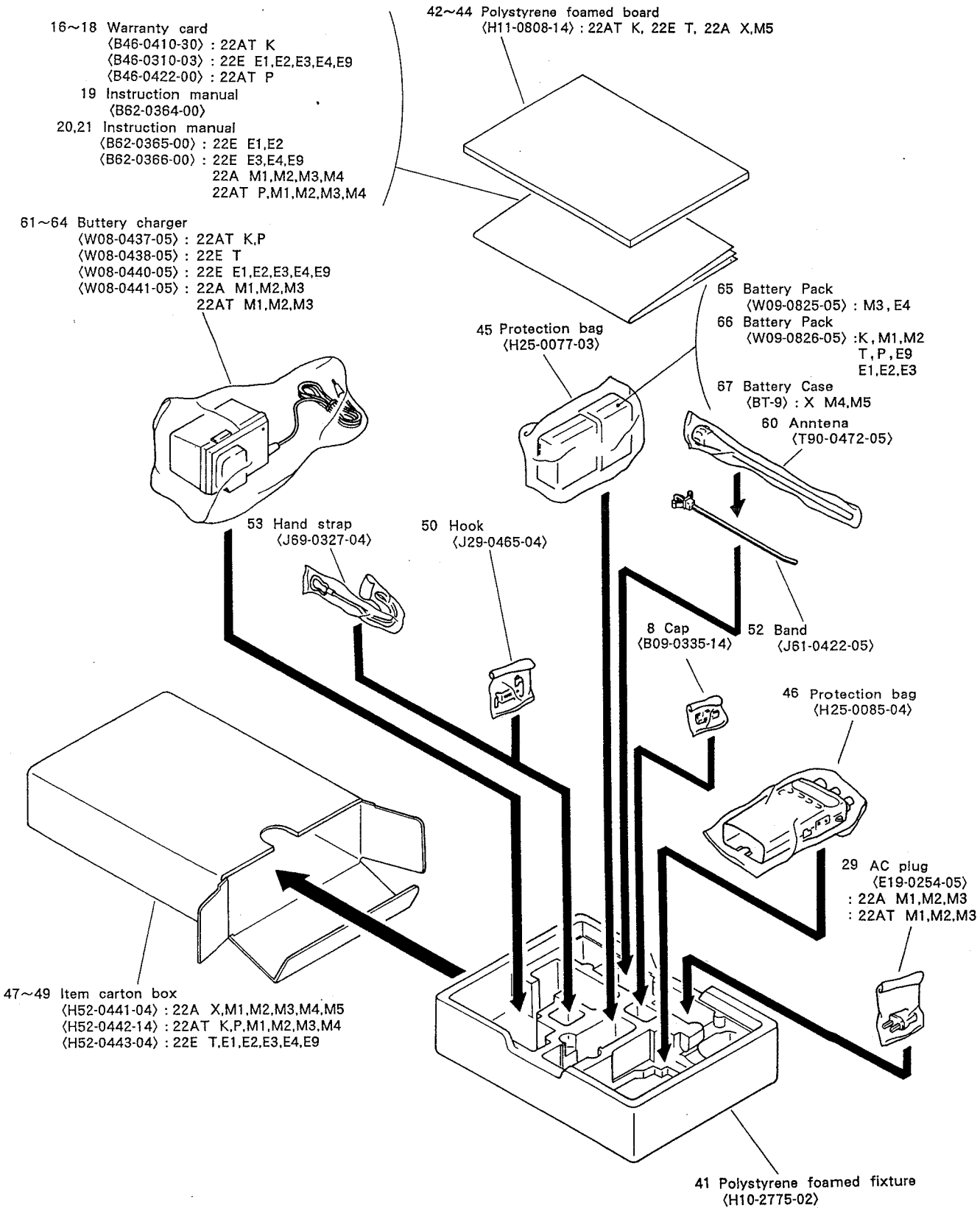
TH-22A/AT/E

EXPLODED VIEW



A	M3 x 4	: N09-2028-05
B	M2.6 x 5	: N30-2605-46
C	M2.6 x 6	: N30-2606-45
D	M2 x 22	: N80-2022-45
E	M2 x 4	: N83-2004-46

PACKING


16~18 Warranty card
⟨B46-0410-30⟩ : 22AT K
⟨B46-0310-03⟩ : 22E E1,E2,E3,E4,E9
⟨B46-0422-00⟩ : 22AT P
19 Instruction manual
⟨B62-0364-00⟩
20,21 Instruction manual
⟨B62-0365-00⟩ : 22E E1,E2
⟨B62-0366-00⟩ : 22E E3,E4,E9
22A M1,M2,M3,M4
22AT P,M1,M2,M3,M4
42~44 Polystyrene foamed board
⟨H11-0808-14⟩ : 22AT K, 22E T, 22A X,M5
61~64 Buttery charger
⟨W08-0437-05⟩ : 22AT K,P
⟨W08-0438-05⟩ : 22E T
⟨W08-0440-05⟩ : 22E E1,E2,E3,E4,E9
⟨W08-0441-05⟩ : 22A M1,M2,M3
22AT M1,M2,M3
45 Protection bag
⟨H25-0077-03⟩
65 Battery Pack
⟨W09-0825-05⟩ : M3, E4
66 Battery Pack
⟨W09-0826-05⟩ :K, M1,M2
T, P, E9
E1,E2,E3
67 Battery Case
⟨BT-9⟩ : X M4,M5
60 Anntena
⟨T90-0472-05⟩
53 Hand strap
⟨J69-0327-04⟩
50 Hook
⟨J29-0465-04⟩
8 Cap
⟨B09-0335-14⟩
52 Band
⟨J61-0422-05⟩
46 Protection bag
⟨H25-0085-04⟩
29 AC plug
⟨E19-0254-05⟩
: 22A M1,M2,M3
: 22AT M1,M2,M3
47~49 Item carton box
⟨H52-0441-04⟩ : 22A X,M1,M2,M3,M4,M5
⟨H52-0442-14⟩ : 22AT K,P,M1,M2,M3,M4
⟨H52-0443-04⟩ : 22E T,E1,E2,E3,E4,E9
41 Polystyrene foamed fixture
⟨H10-2775-02⟩

TERMINAL FUNCTION

TX-RX unit (A/4): TX-RX ←→TX-RX unit (B/4): CONTROL

Connector No.	Pin No.	Pin name	Function
CN1, 203	1	MUTE	Audio mute signal (TX-RX line)
	2	SB	Power supply
	3	NC	
	4	BUSY	Squelch control signal
	5	AF	RX audio
	6	SM	S-meter level
	7	CI	Signalling AF signal
	8	UP	Encoder up signal
	9	3M	Reference power supply voltage 3.5 V
	10	DN	Encoder down signal
	11	APC	APC voltage
	12	RB	Power module power supply voltage
	13	EP	PLL IC enable signal
	14	ASB	AF power amplifier AVR input voltage
	15	DT	Serial data signal
	16	E	GND
	17	UL	PLL unlock signal
	18	3R	Receiver power supply
	19	CK	Clock signal
	20	3C	PLL IC, VCO power supply
	21	TX	VCO oscillation frequency switching signal
	22	3T	Transmitter power supply
	23	MOD	Modulation signal

TX-RX unit (A/4): TX-RX ←→ VCO unit

Connector No.	Pin No.	Pin name	Function
CN1, 2		CV	Lock voltage
		MOD	Modulation signal
		3C	VCO power supply voltage
		TX	VCO oscillation frequency switching signal
		OUTP	fin VCO output
		OUT	RF output

TX-RX unit (B/4): CONTROL ←→ PTT

Connector No.	Pin No.	Pin name	Function
CN201 CN301	1	COM	Key matrix input
	2	MONI	Key matrix output, Monitor switch
	3	LAMP	Key matrix output, Lamp switch
	4	PTT	PTT switch signal, "L": TX; "H": RX
	5	E	GND
	6	E	GND

TERMINAL FUNCTION

TX-RX unit (B/4): CONTROL ←→ FUNCTION

Connector No.	Pin No.	Pin name	Function
A4		KSIN0	Key matrix input
		KOUT3	Key matrix output, Function switch
		KOUT2	Key matrix output, VFO SW
		KOUT1	Key matrix output, MR SW
		KOUT0	Key matrix output, CALL SW

TX-RX unit (B/4): CONTROL ←→ KEYPAD

Connector No.	Pin No.	Pin name	Function
CN202	1	KOUT0	Key matrix output
	2	KOUT1	Key matrix output
	3	KOUT2	Key matrix output
	4	KOUT3	Key matrix output
	5	KSIN2	Key matrix input
	6	KSIN3	Key matrix input
	7	KSIN4	Key matrix input
	8	KSIN5	Key matrix input

TX-RX unit (B/4): CONTROL ←→ TSU-8 (option)

Connector No.	Pin No.	Pin name	Function
CN204	1	CK	Clock signal
	2	DT	Serial data signal
	3	ET	TSU-8 enable signal
	4	NC	
	5	SPO	Tone signal match identification signal
	6	E	GND
	7	3M	TSU-8 power supply
	8	CI	Signalling AF signal

TH-22A/AT/E

ADJUSTMENT

Required Test Equipment

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

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

4. Power Meter
1) Measurable frequency: Up to 500MHz.
2) Impedance: 50Ω, unbalanced.
3) Measuring range: Full scale 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 measurements for 5 to 25MHz.

9. AF Voltmeter (AF V.M)
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: 0.05μV/–133dBm to 0.1V/–7dBm.
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.

14. Distortion Meter
1) Measurable frequency: 30Hz to 100kHz.
2) Input level: 50mV to 10Vrms.

ADJUSTMENT

TX/RX Common Adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Setting	1) Power supply DC IN terminal: 6.3V ⊕—●—⊖							Note) BATT terminal: 6.0V
2. Reset	1) While pressing the F key down, set the POWER: ON.				Display check.			All segments on.
	2) F key: Release				Check the Reset frequency.			144.00

PLL Adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. VCO voltage	1) Frequency: Center frequency Receive.	Digital Voltmeter	TX-RX	CV			Check	1.25 to 2.8V
	2) Transmit (PTT: ON).							1.5 to 3.2V

TX Adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Transmit Frequency	1) Frequency: 144.90MHz PTT: ON	f.counter Power meter	TX-RX	ANT	RF/IF	TC1	144.90 MHz	± 500Hz or less.
2. Power output	1) Max. power DC IN terminal: 10.6V Frequency: 146.00MHz: **K,P,X, M1,M2,M3,M4,E2** 144.975MHz: **M5,T,E1,E3,E4,E9** Power select: HI PTT: ON	Power meter Ammeter	TX-RX	ANT	CONTROL	VR201	Check.	5.5W or more.
	2) HI power PTT: ON						Adjust to 5.5W	±0.1W (Current consumption 1.7A or less.)
	3) LOW power DC IN terminal voltage: 7.0V Power select: LO PTT: ON						Check	0.3 to 1.0W. (Current consumption 0.8A or less.)
	4) EL power Power select: EL PTT: ON						Check	10 to 300mW (Current consumption 0.3A or less.)
	5) HI power Power select: HI PTT: ON						Check	2W or more.
	6) Frequency: 144.00MHz and 147.975MHz: **K,P, X,M1,M2,M3,M4,E2** 145.975MHz: **M5,T,E1,E3,E4,E9** PTT: ON						Check	2W or more.
3. Modulation	1) Frequency: 146.00MHz: **K,P, X, M1, M2,M3,M4,E2** 144.975MHz:**M5,T,E1,E3,E4,E9** AG output: 1kHz/50mV PTT:ON	Power meter Linear detector Oscillo-scope AG AF V.M	TX-RX	ANT MIC	CON-TROL	VR202	Adjust to ±4.2kHz at large deflect of ±. Check detection waveform.	±0.1kHz Must be normal.
	2) AG Output: 1kHz/5mV (20dB down) PTT:ON						Check DEV	2.2 to 3.5kHz

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
4. DTMF deviation (KEY type only)	1) AG output: OFF Frequency: 144.975MHz D key: Push PTT: ON	Power meter Linear detector Oscillo-scope AG AF V.M	TX-RX	ANT MIC			Check DEV	2.7 to 4.0 kHz
5. TONE deviation (88.5 Hz)	1) Frequency: 144.975MHz T/CT key: Push PTT: ON						Check Display Check DEV	Display "T" on. DEV: 0.5 to 1.25kHz

RX Adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. BPF	1) Frequency: 145.975MHz Tracking generator output :-40dBm Connect the spectrum analyzer to TP.	Traking generator Spectrum analyzer	TX-RX	ANT TP	RF/IF	L11 L12 L13	Align to set the waveform of spectrum analyzer to Fig. 2.	
2. Sensitivity	1) Frequency: 144.05MHz SSG output: -122dBm (0.178 µV) MOD: 1kHz DEV: ±3kHz AF VR: 0.63V/8Ω	SSG Oscillo-scope AF V.M Distortion meter	TX-RX	ANT SP			Check	SINAD 12dB or more.
	2) Frequency: 147.950MHz:**K,P,X, M1,M2,M3,M4,E2** 145.950MHz: **M5,T, E1,E3,E4,E9**							
3. Squelch	1) Push F key, then push MONI key. Turn the encoder to display "SqL3".	SSG Oscillo-scope AF V.M	TX-RX	ANT SP	RF/IF		Check	
	2) Frequency: 146.05MHz: **K,P,X, M1,M2,M3,M4,E2** 145.05MHz: **M5,T, E1,E3,E4,E9** SSG output: -132dBm (0.06µV) MOD: 1kHz DEV: ±3kHz AF VR: 0.63V/8Ω					VR2	Adjust where noise disappear.	
	3) SSG output: -127dBm (0.1µV)						Check	Squelch should be open.
4. S-meter level	1) Frequency: 146.05MHz: **K,P,X, M1,M2,M3,M4,E2** 145.05MHz: **M5,T, E1,E3,E4,E9** While shorting the SM terminal of the control section, set the POWER: ON.	SSG	TX-RX	ANT SP			Check (After POWER is ON, remove the short)	Display "AbCdE"
	2) SSG output: -120dBm (0.22µV)						Push MONI key.	Beep sounds.
	3) SSG output: -111dBm (0.63µV)						Push LAMP key.	Beep sounds.
	4) Power: OFF							
	5) Power: ON SSG output: -120dBm±3dBm (0.22µV)						Check S-meter	1st segment is turned on. ■■
	6) SSG output: -111dBm±3dBm (0.63µV)							All segments are turned on. ■■■■■■■■■

ADJUSTMENT

Adjustment Points

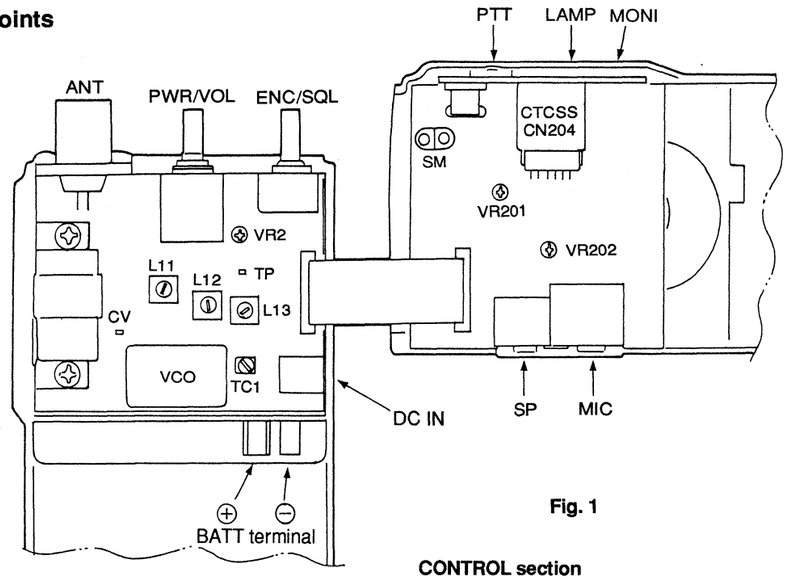


Fig. 1

TX-RX UNIT

RF-IF section
TC1: Transmit frequency
L11, 12, 13: BPF
VR2: Squelch
CV terminal: VCO voltage
TP terminal: BPF output (Spectrum analyzer)

CONTROL section

VR201: HI power
VR202: DEV
SM terminal: S-meter level
(Short when turn the POWER ON.)

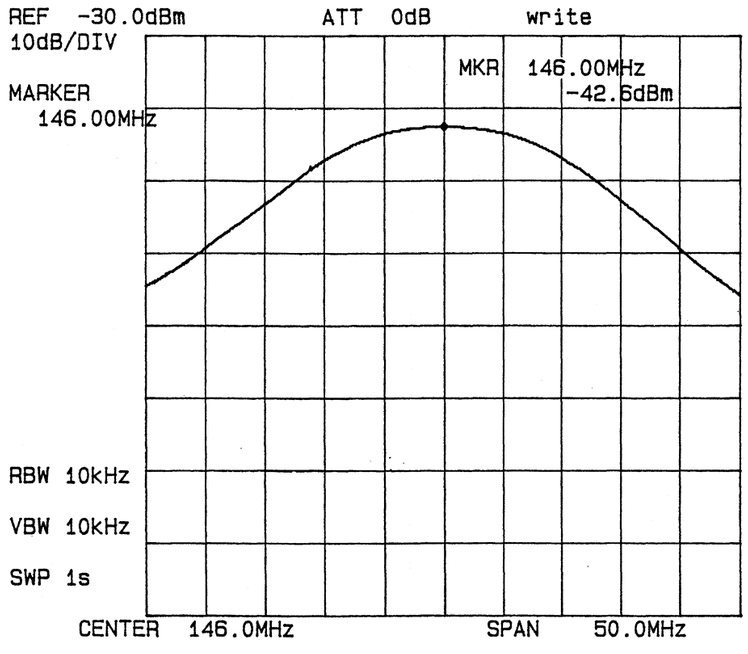
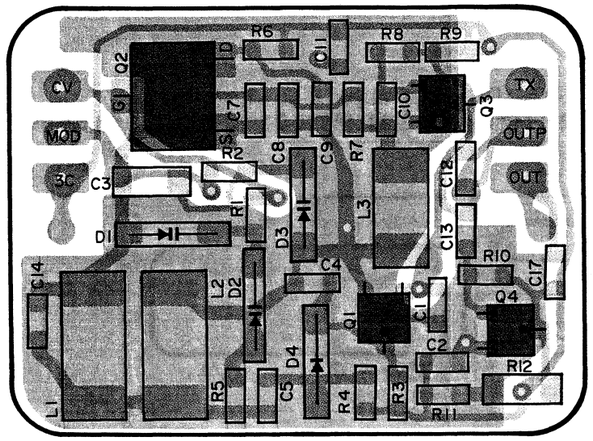


Fig. 2 BPF waveform

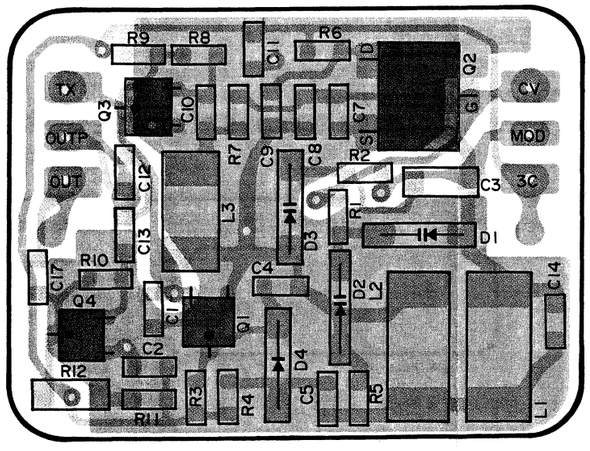
PC BOARD VIEWS TH-22A/AT/E

VCO UNIT (X58-4090-00) Component side view



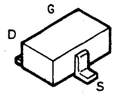
A pattern
B pattern

VCO UNIT (X58-4090-00) Foil side view



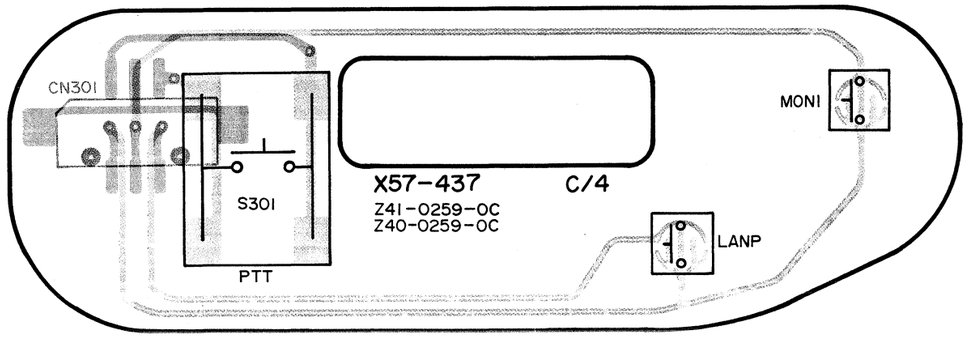
DTC144EE
2SC4808

2SK238



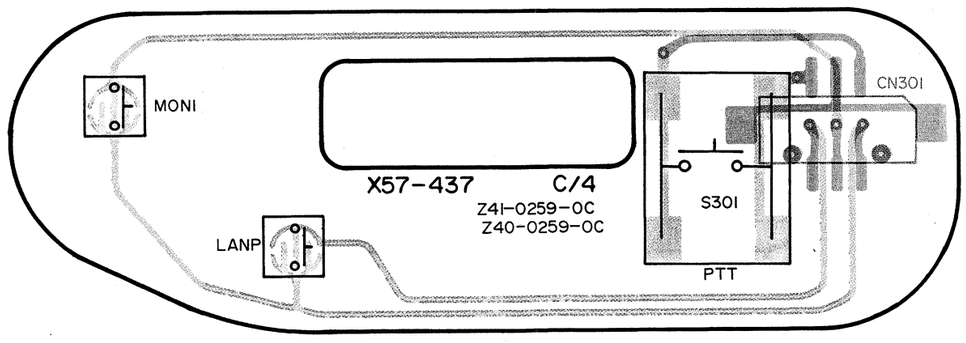
TH-22A/AT/E PC BOARD VIEWS

TX-RX UNIT (X57-437X-XX) (C/4) Component side view
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2

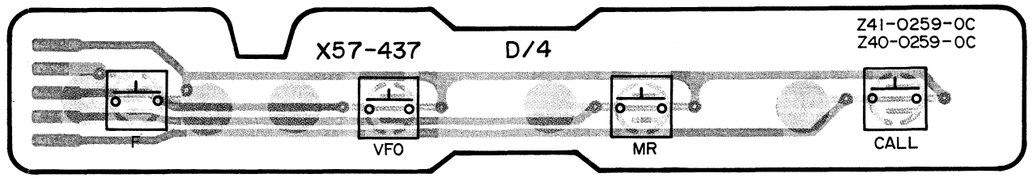


A pattern
B pattern

TX-RX UNIT (X57-437X-XX) (C/4) Foil side view
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2

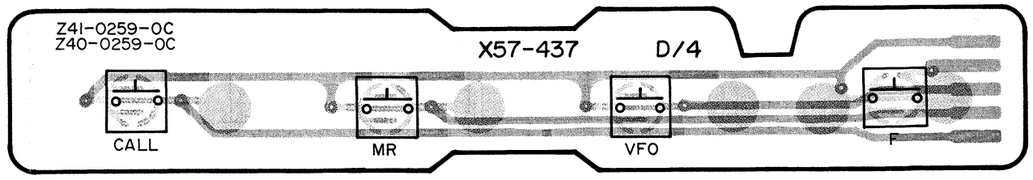


TX-RX UNIT (X57-437X-XX) (D/4) Component side view
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2

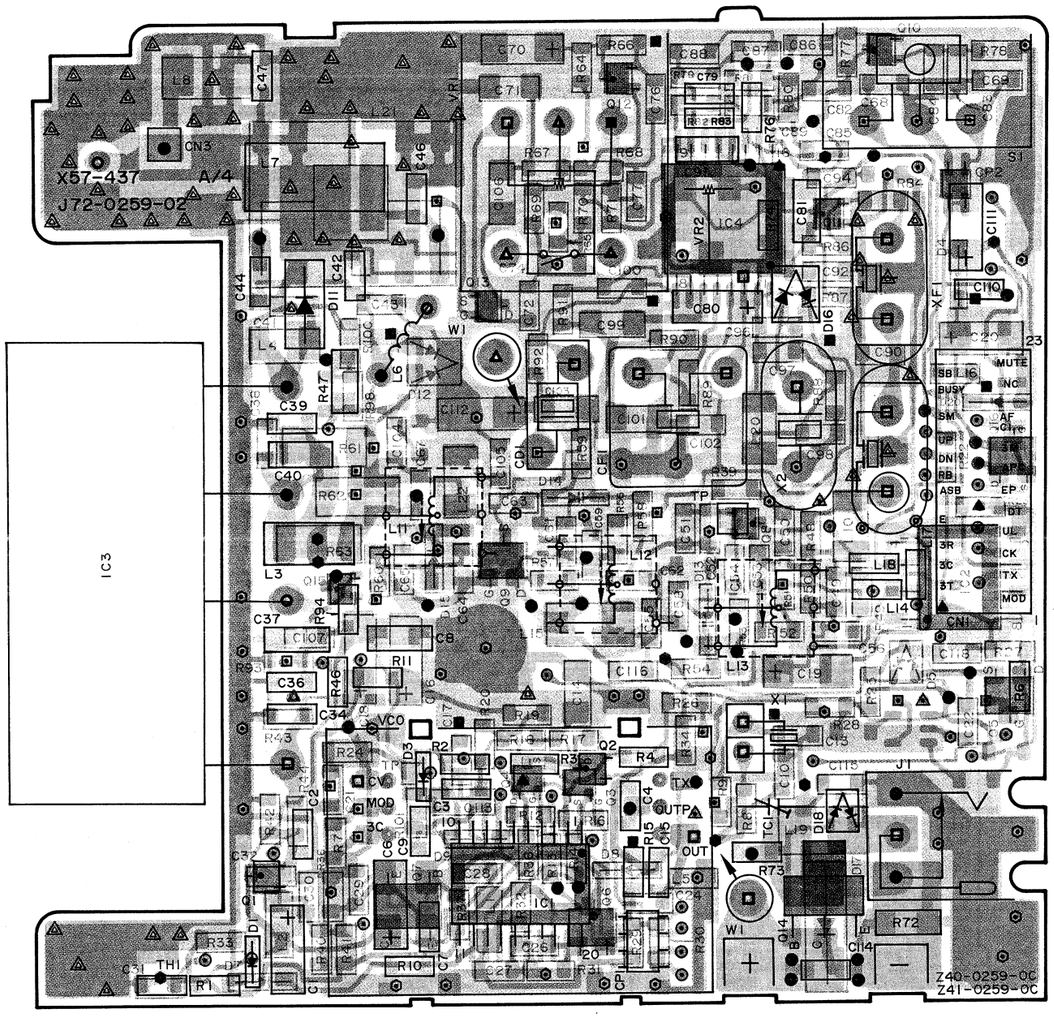


A pattern
B pattern

TX-RX UNIT (X57-437X-XX) (D/4) Foil side view
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2



TX-RX UNIT (X57-437X-XX) (A/4) Component side view
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2

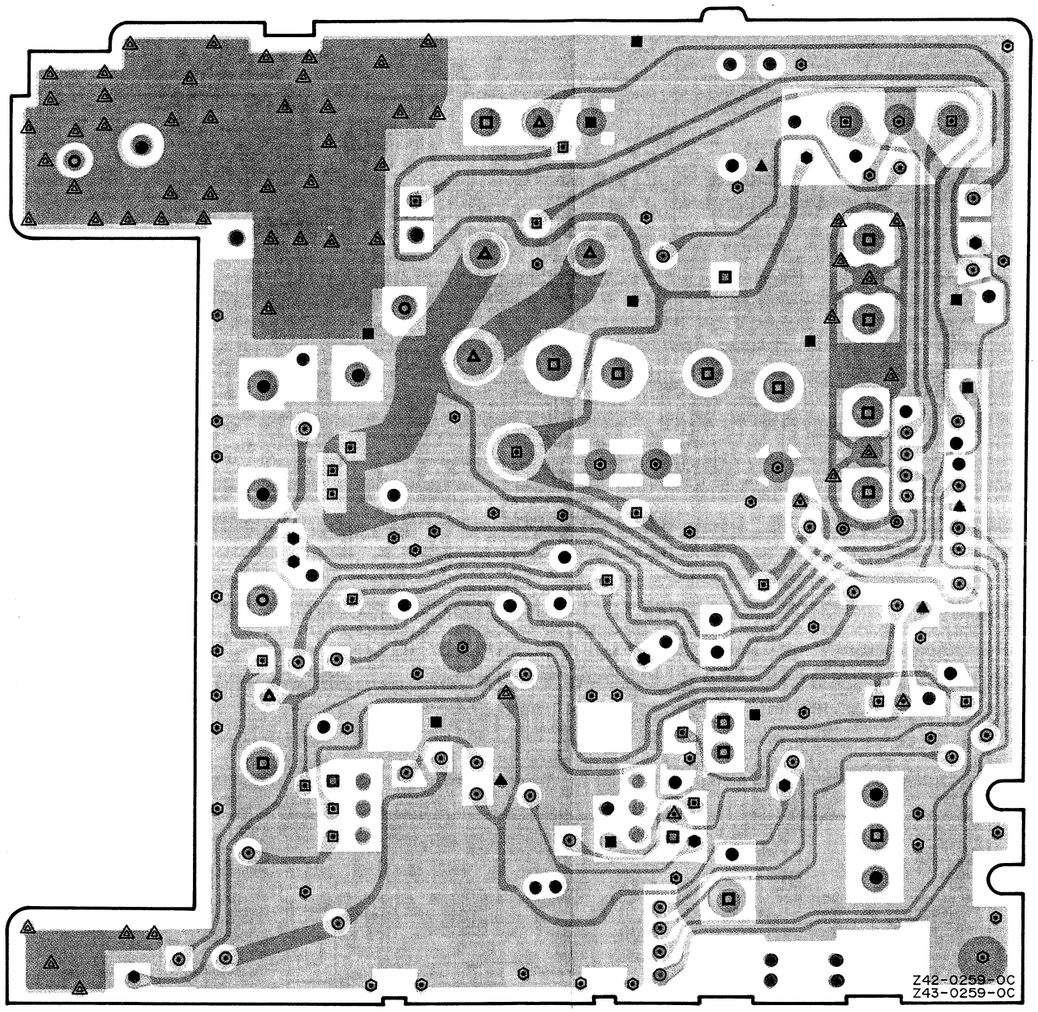


A pattern
B pattern

Component side
A pattern
C pattern
D pattern
B pattern
Foil side

- A and B connected
- A and C connected
- A and D connected
- B and C connected
- B and D connected
- C and D connected
- A, C and B connected
- A, D and B connected
- A, C and D connected
- C, D and B connected
- A, C, D and B connected
- B only

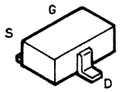
No mark is not connected



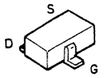
C pattern
D pattern

2SC4619
2SC4738
2SC4083
2SC4808

2SJ243
2SK1824



2SK879



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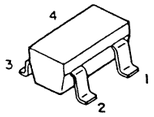
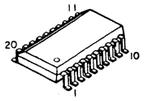
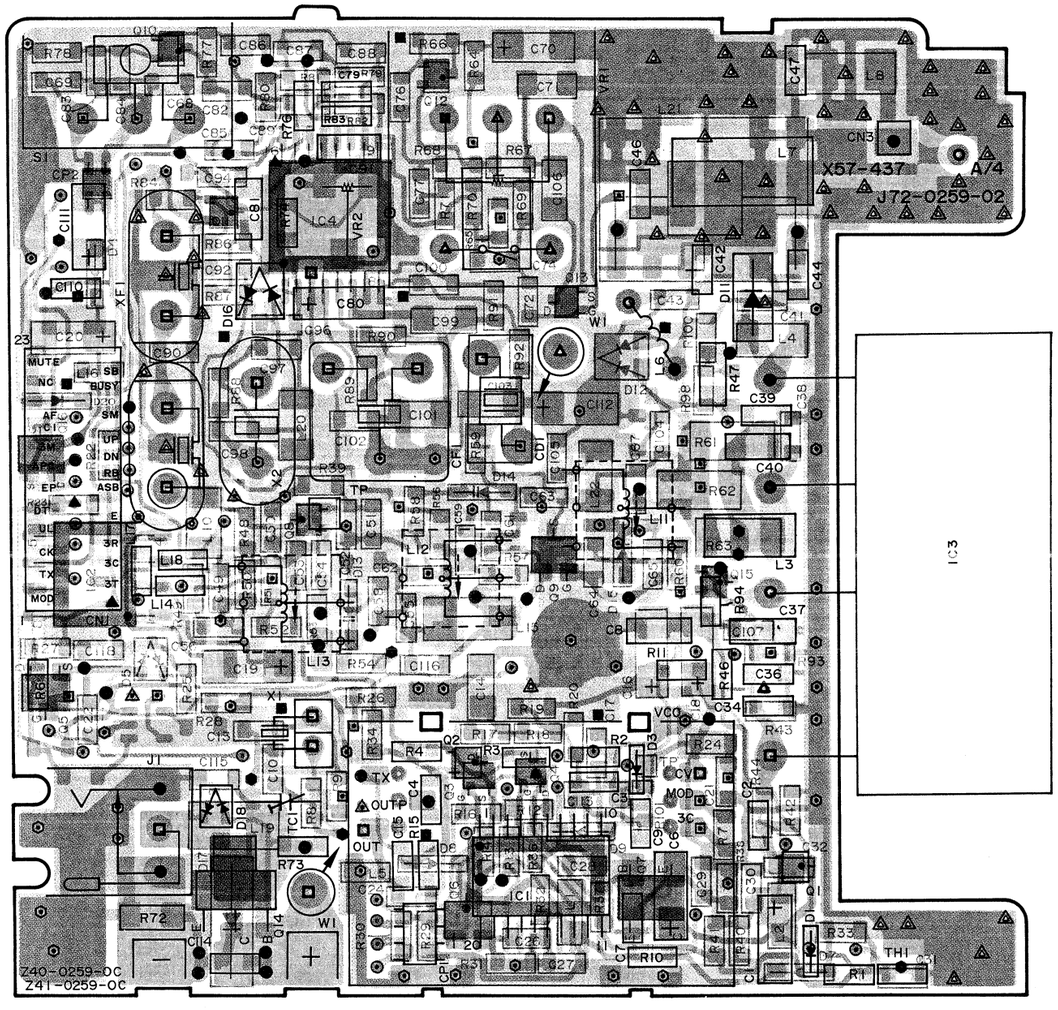
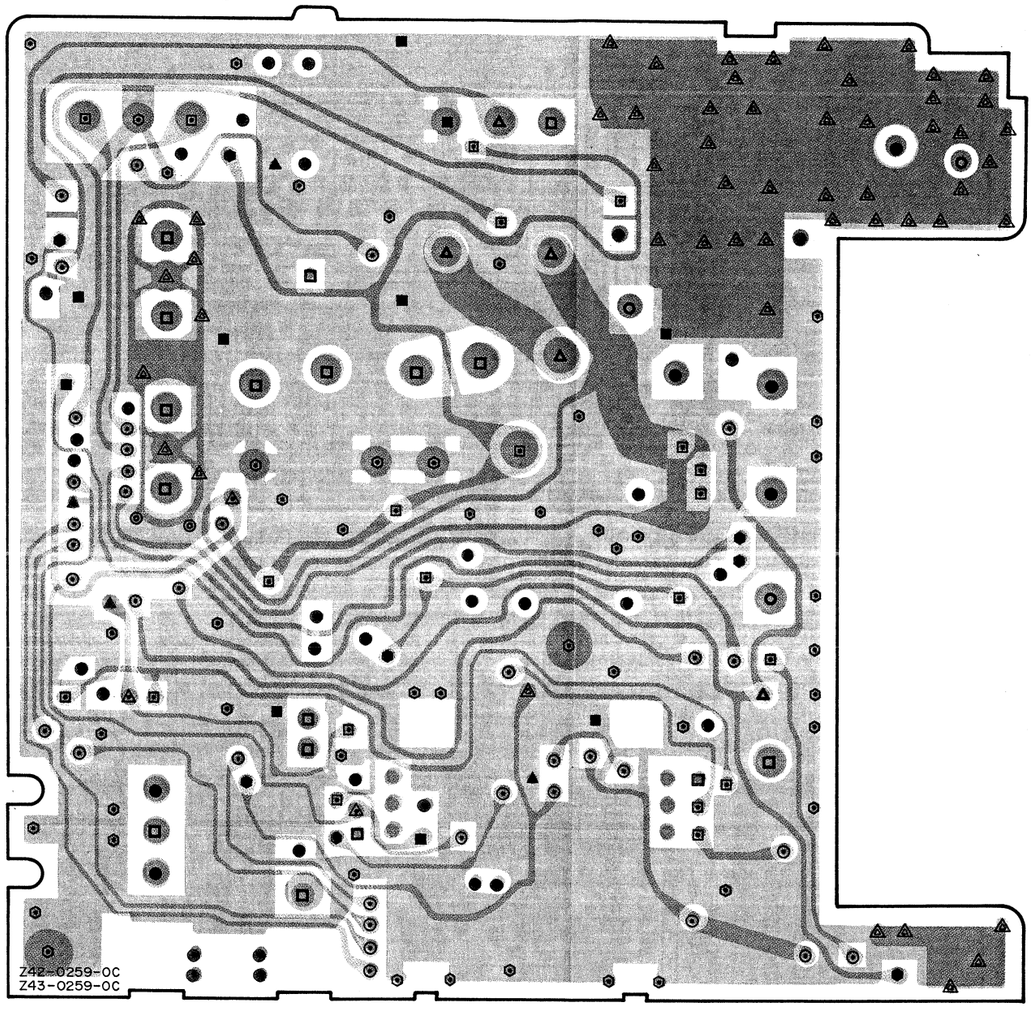


MB1511PFV-G-BND



TX-RX UNIT (X57-437X-XX) (A/4) Foil side view
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2





A pattern
B pattern

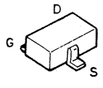
C pattern
D pattern

Component side
A pattern
C pattern
D pattern
B pattern
Foil side

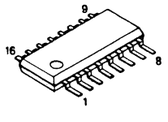
- A and B connected
- A and C connected
- A and D connected
- B and C connected
- B and D connected
- C and D connected
- A, C and B connected
- A, D and B connected
- A, C and D connected
- C, D and B connected
- A, C, D and B connected
- B only

No mark is not connected

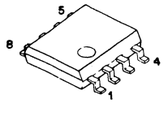
2SK1215



MC3372V

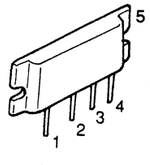


TC7660MEOA



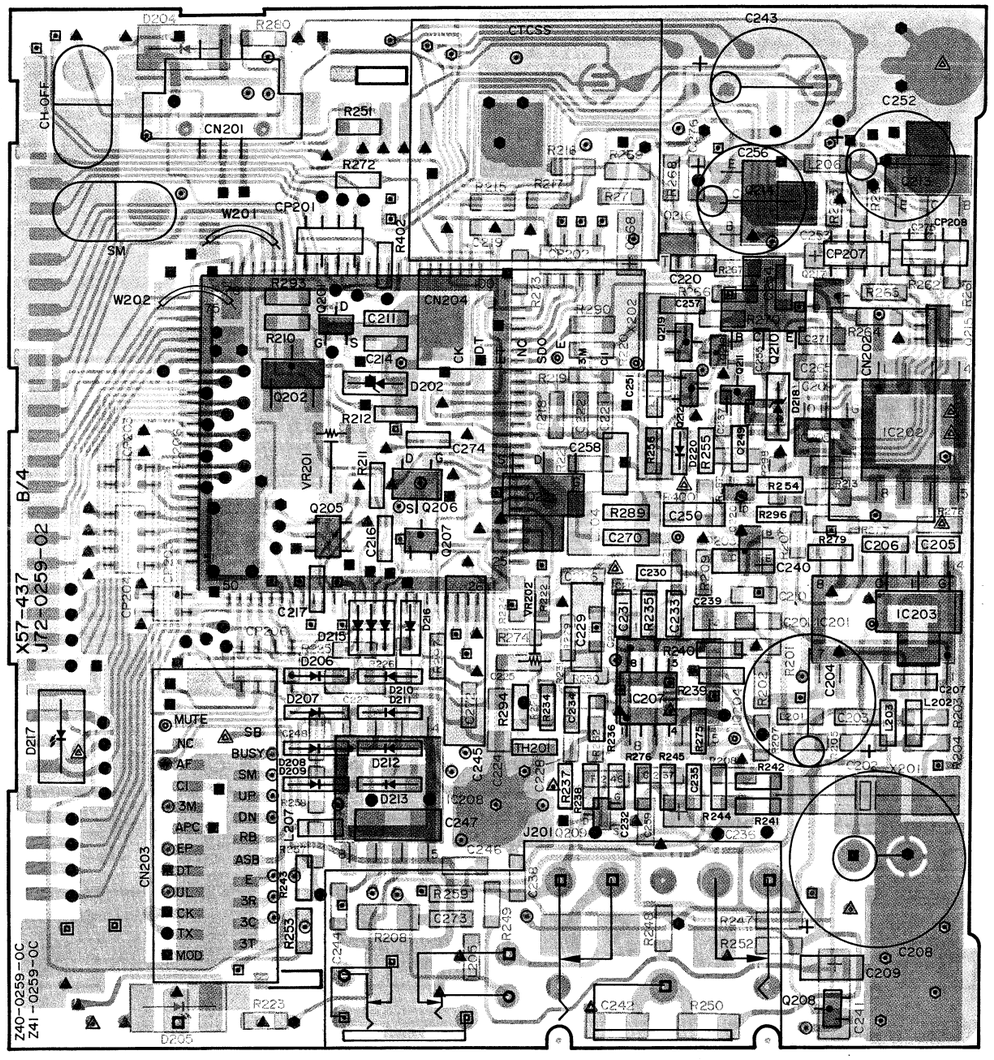
2SD1483

PF0310-01



TH-22A/AT/E PC BOARD VIEWS

TX-RX UNIT (X57-437X-XX) (B/4) Component side view
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2

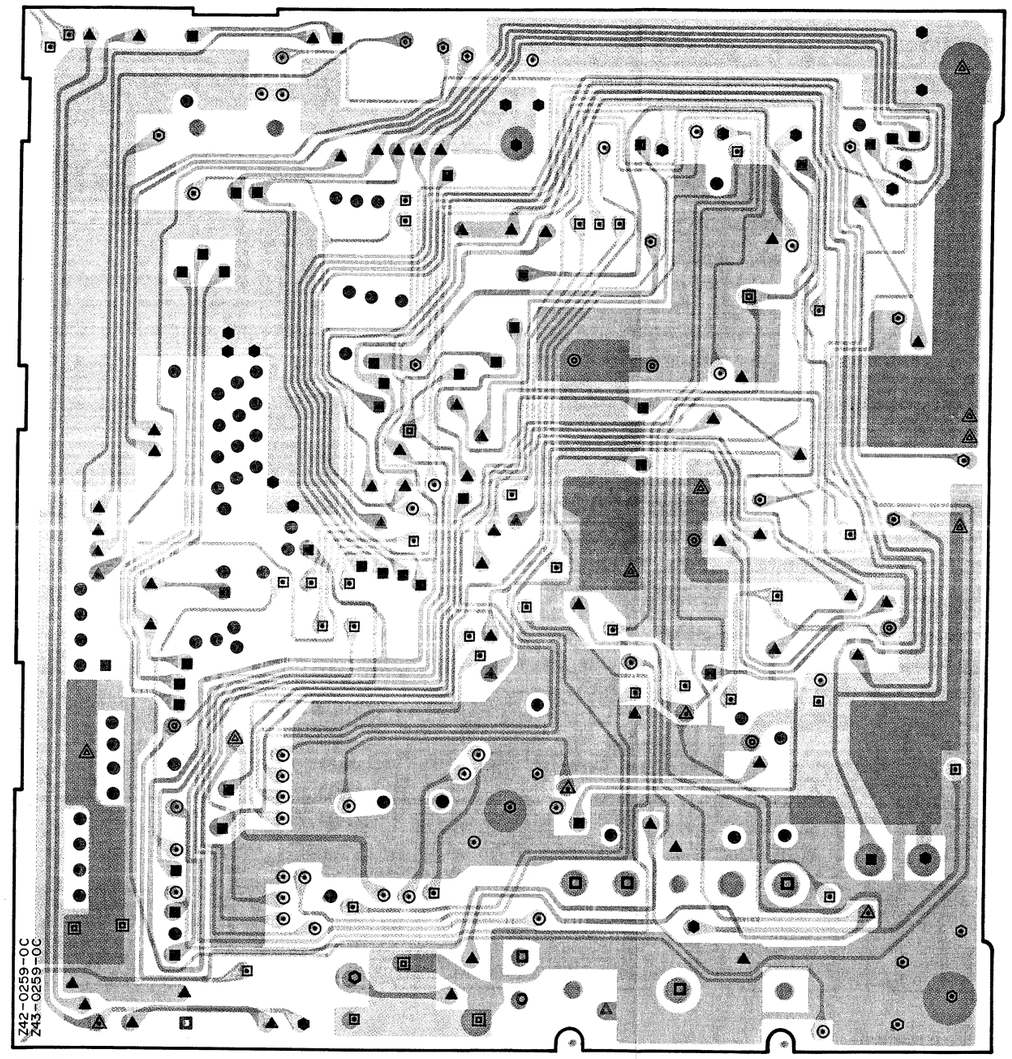


A pattern
B pattern

Component side
A pattern
C pattern
D pattern
B pattern
Foil side

- A and B connected
- A and C connected
- A and D connected
- B and C connected
- B and D connected
- C and D connected
- A, C and B connected
- A, D and B connected
- A, C and D connected
- A, C, D and B connected
- A only
- B only
- C only

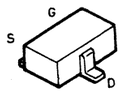
No mark is not connected



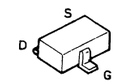
C pattern
D pattern

2SC4738
DTA143ZE
DTA144EE
DTC114YE
DTA114EU

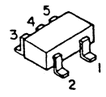
2SK1824
2SJ243
2SJ204



2SK879

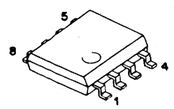


UMW1

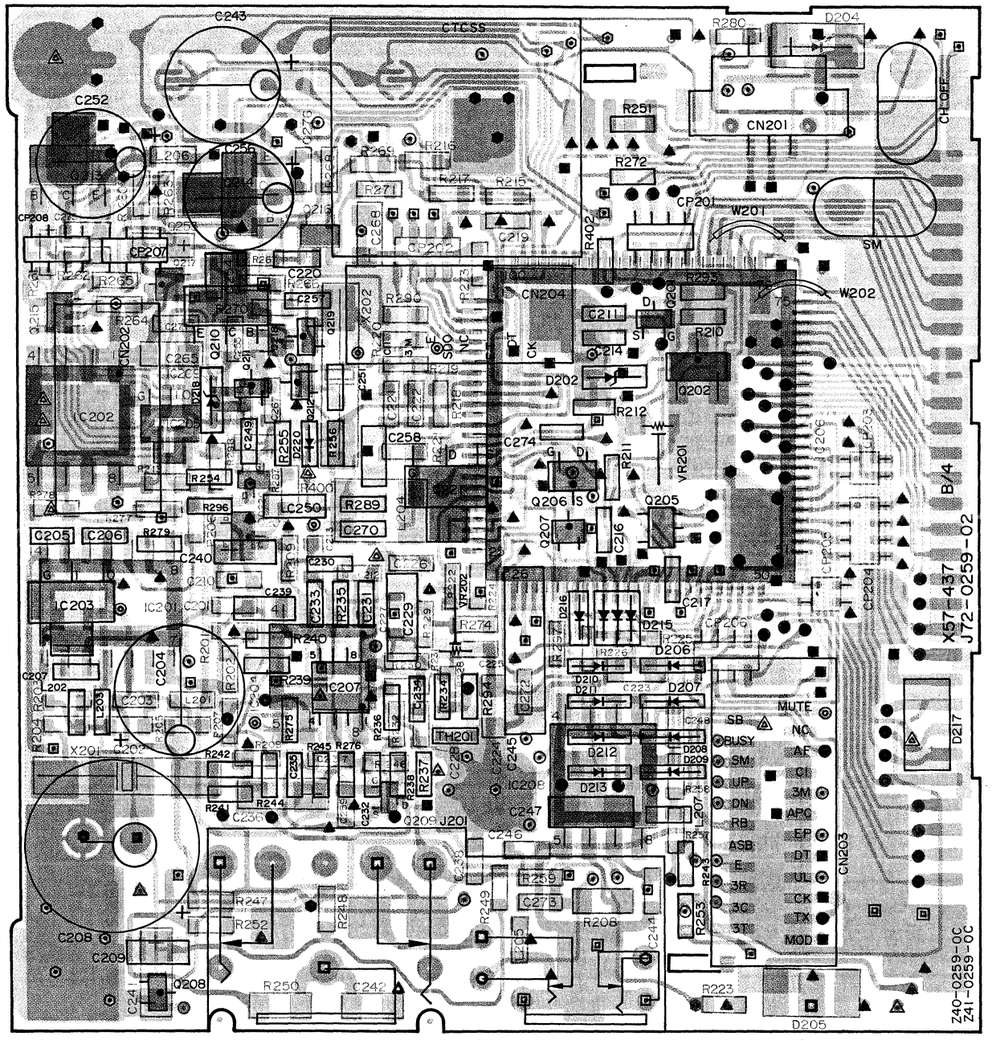


2SB766

AT24C04N10SI2.5
LM301AD
NJM2070M
TA75W558FU



TX-RX UNIT (X57-437X-XX) (B/4) Foil side view
0-11: K,P 0-21: M1 0-22: M2,M3,M4 0-23: M5 0-71: X 2-71: E1,E3,E4,E9,T 2-72: E2

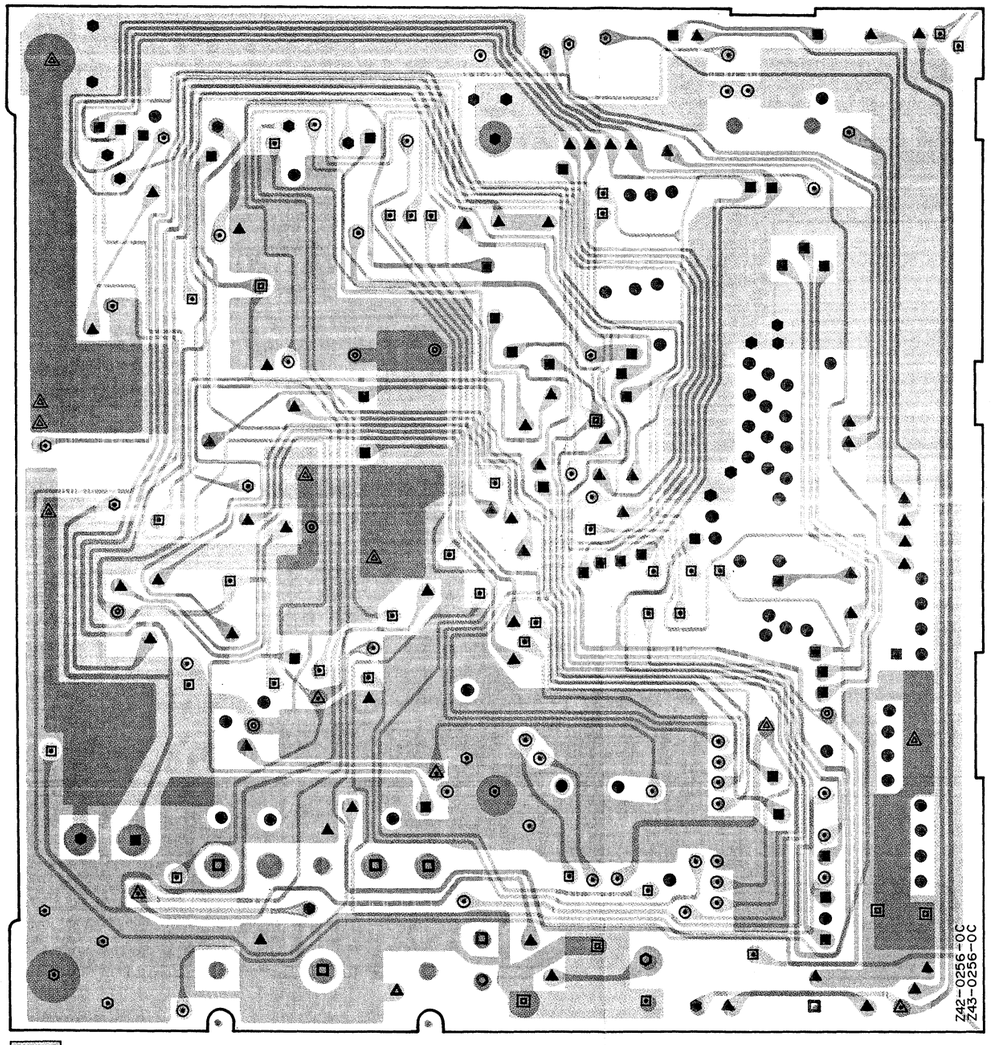


A pattern
B pattern

Component side
A pattern
C pattern
D pattern
B pattern
Foil side

- A and B connected
- A and C connected
- A and D connected
- B and C connected
- B and D connected
- C and D connected
- A, C and B connected
- A, D and B connected
- A, C and D connected
- A, C, D and B connected
- A only
- B only
- C only

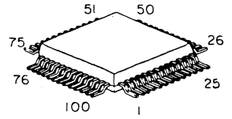
No mark is not connected



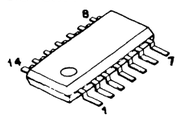
C pattern
D pattern

2SK1588

HD404629B17TF

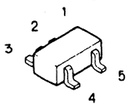


LC7387M-L

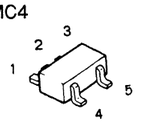


S-80730SN-DT
S-81235PG-PI

TC7S08FU



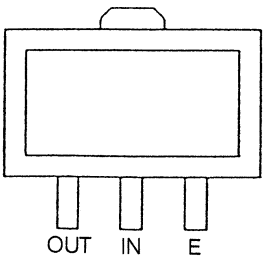
UMC4



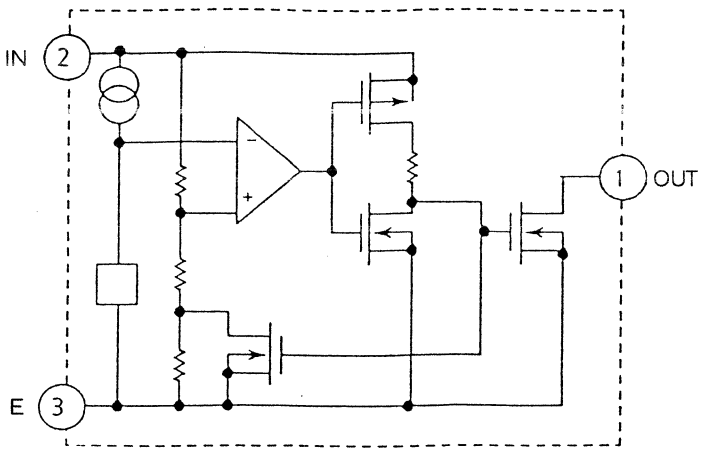
SEMICONDUCTOR DATA

HI-PRECISION VOLTAGE DETECTER : S-80719AN-DG(IC501)

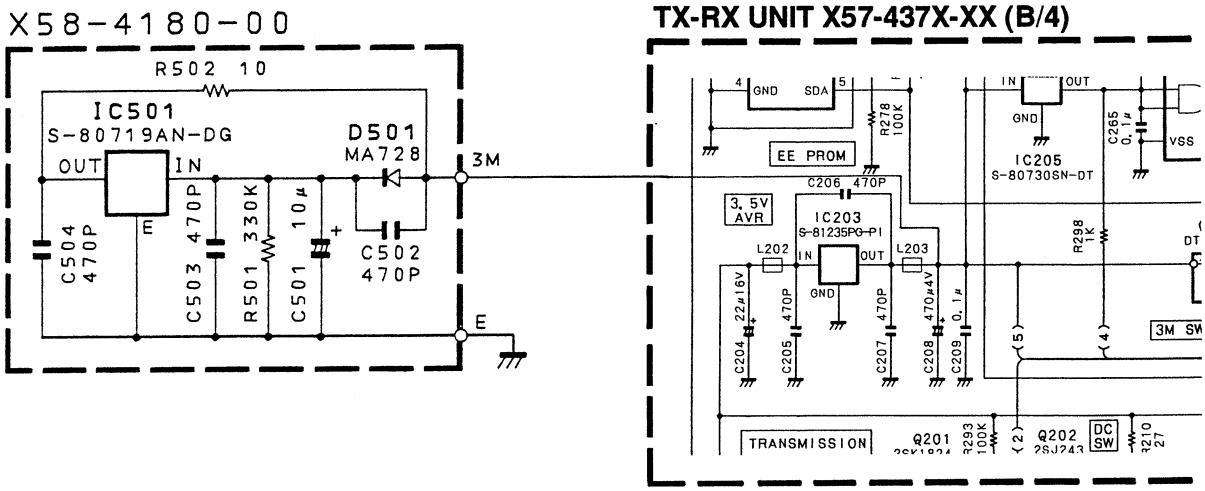
Pin connection diagram



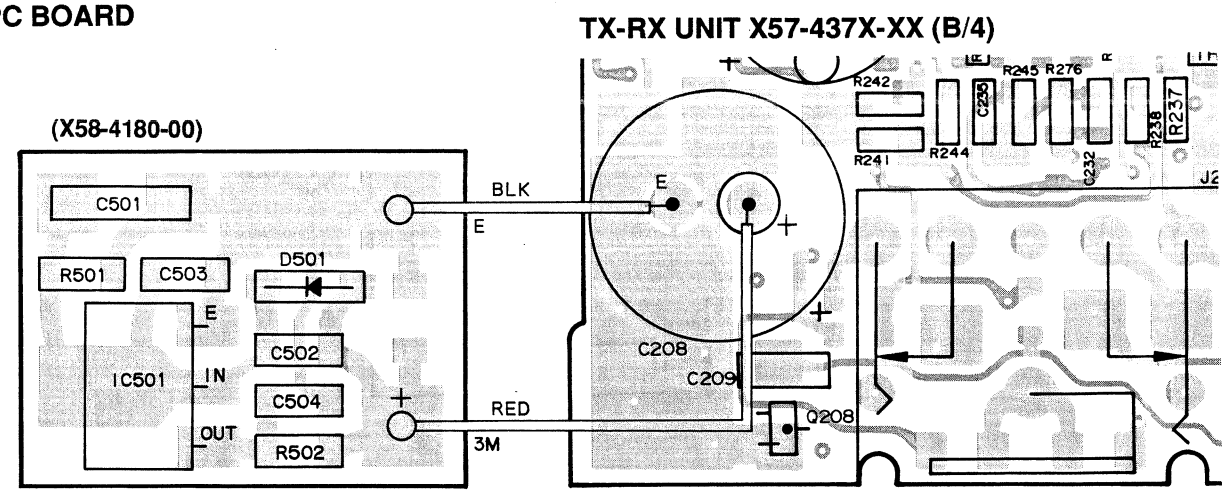
Block diagram



SUB UNIT (X58-4180-00)



PC BOARD



PARTS LIST

Ref. No.	Address	New Parts	Parts No.	Description	Destination	Remarks
SUB UNIT (X58-4180-00)						
C501			C92-0544-05	TANTAL 10uF 4WV		
C502-504			CK73GB1H471K	CHIP C 470PF K		
R501			RK73GB1J334J	CHIP R 330K J 1/16W		
R502			RK73GB1J100J	CHIP R 10 J 1/16W		
D501			MA728	DIODE		
IC501		*	S-80719AN-DG	IC		

TX-RX UNIT X57-437X-XX(B/4)

A B C D E F G H I J

LCD

IC206 HD404629B17TF μ-COM

IC201 LC7387M-L DTMF RECEIVER

IC202 AT24C04N10SI2.5 EE PROM

IC203 S-81235PG-PI 3.5V AVR

IC204 LM301AD APC COMPARATOR

IC205 S-80730SN-DT VOLTAGE DETECTION

IC207 TA75W558FU MIC AMP

IC208 NJM2070M AF POWER AMP

IC209 TC7S08FU RESET CIRCUIT COMPALATOR

Q201 2SK1824 TRANSMISSION POWER CHANGE OVER SW

Q202 2SJ243 DC SW

Q203 DTA114EU APC VOLTAGE CONTROL

Q205 UMC4 TRANSMISSION POWER CHANGE OVER SW

Q206 2SK879(Y) CONSTANT CURRENT

Q207 DTC114YE APC CIRCUIT POWER SUPPLY SW

Q208 DTA143ZE 3M SW

Q209 2SK1824 MUTE SW

Q210 2SB766(R,S)

Q211 2SC4738(GR) ERROR AMP

Q212 DTA144EE AF AMP POWER SUPPLY SW

Q213 2SB766(R,S) AVR

Q214 2SB766(R,S) AVR

Q215,216 DIFFERENTIAL DC AMP

Q217 2SK1824 3T SW

Q218 2SK1824 3C SW

Q219 DTA143ZE 3R SW

Q220 2SJ243 RESET

D204 LED

D205 LED

D206-216 REVERSE FLOW PREVENTION

D215 HN2D01FU

D216 MA2S111

D217 B30-2115-05 LED

D218 DTZ3.9B CONSTANT VOLTAGE

D220 MA2S111 QUICK DIS CHARGE

D202 MA8039 HI POWER

CONSTANT VOLTAGE

CONSTANT CURRENT

SM TUNING MEMOLY INPUT CH DISPLAY OFF

EL, RX:HI HI, LO:LO

PTT X57-C/4

FUNCTION KEY X57-D/4

KEY BOARD ASSY S79-0412-05

TSU-8 X52-3290-0(CTCSS UNIT OPTION

DC IN

SP MIC J201

CN201 CN202 CN203 CN204 CN301

PTT X57-C/4

FUNCTION KEY X57-D/4

KEY BOARD ASSY S79-0412-05

TX-RX UNIT X57-437X-xx(A/4)

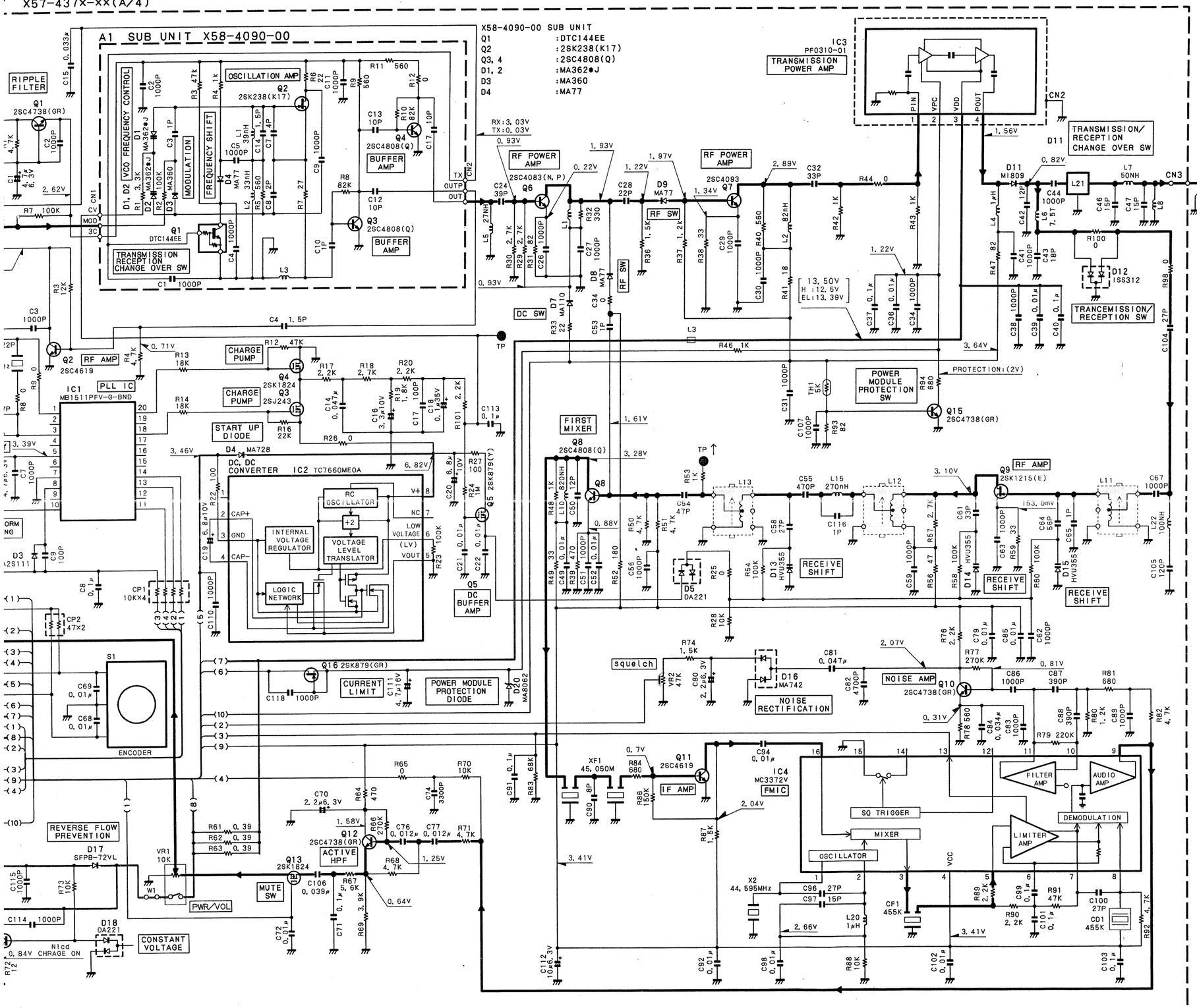
A1 SUB UNIT X58-4090-00

X58-4090-00 SUB UNIT
Q1 :DTC144EE
Q2 :2SK238(K17)
Q3, 4 :2SC4808(Q)
D1, 2 :MA362*J
D3 :MA360
D4 :MA77

TSU-8 X52-3290-00 CTCSS UNIT OPTION

SCHEMATIC DIAGRAM TH-22A/AT/E

X57-437X-XX(A/4)



X57-437X-XX B/4

		X-xx	D208	D209	D212	D213	✱A
TH-22AT	K	0-11	YES	YES	NO	NO	YES
TH-22AT	P	0-11	NO	NO	NO	NO	YES
TH-22AT	M1	0-21	NO	NO	NO	NO	YES
TH-22AT	M2	0-22	NO	NO	NO	NO	YES
TH-22AT	M3	0-22	NO	NO	NO	NO	YES
TH-22AT	M4	0-22	NO	NO	NO	NO	YES
TH-22A	X	0-71	YES	YES	NO	NO	OPTION
TH-22A	M1	0-21	YES	NO	YES	NO	OPTION
TH-22A	M2	0-22	NO	NO	YES	YES	OPTION
TH-22A	M3	0-22	YES	NO	NO	YES	OPTION
TH-22A	M4	0-22	NO	NO	YES	YES	OPTION
TH-22A	M5	0-23	NO	NO	NO	NO	OPTION
TH-22E	T	2-71	NO	NO	NO	NO	OPTION
TH-22E	E1	2-71	YES	YES	YES	NO	OPTION
TH-22E	E2	2-72	NO	YES	YES	NO	OPTION
TH-22E	E3	2-71	NO	NO	NO	NO	OPTION
TH-22E	E4	2-71	NO	NO	NO	NO	OPTION

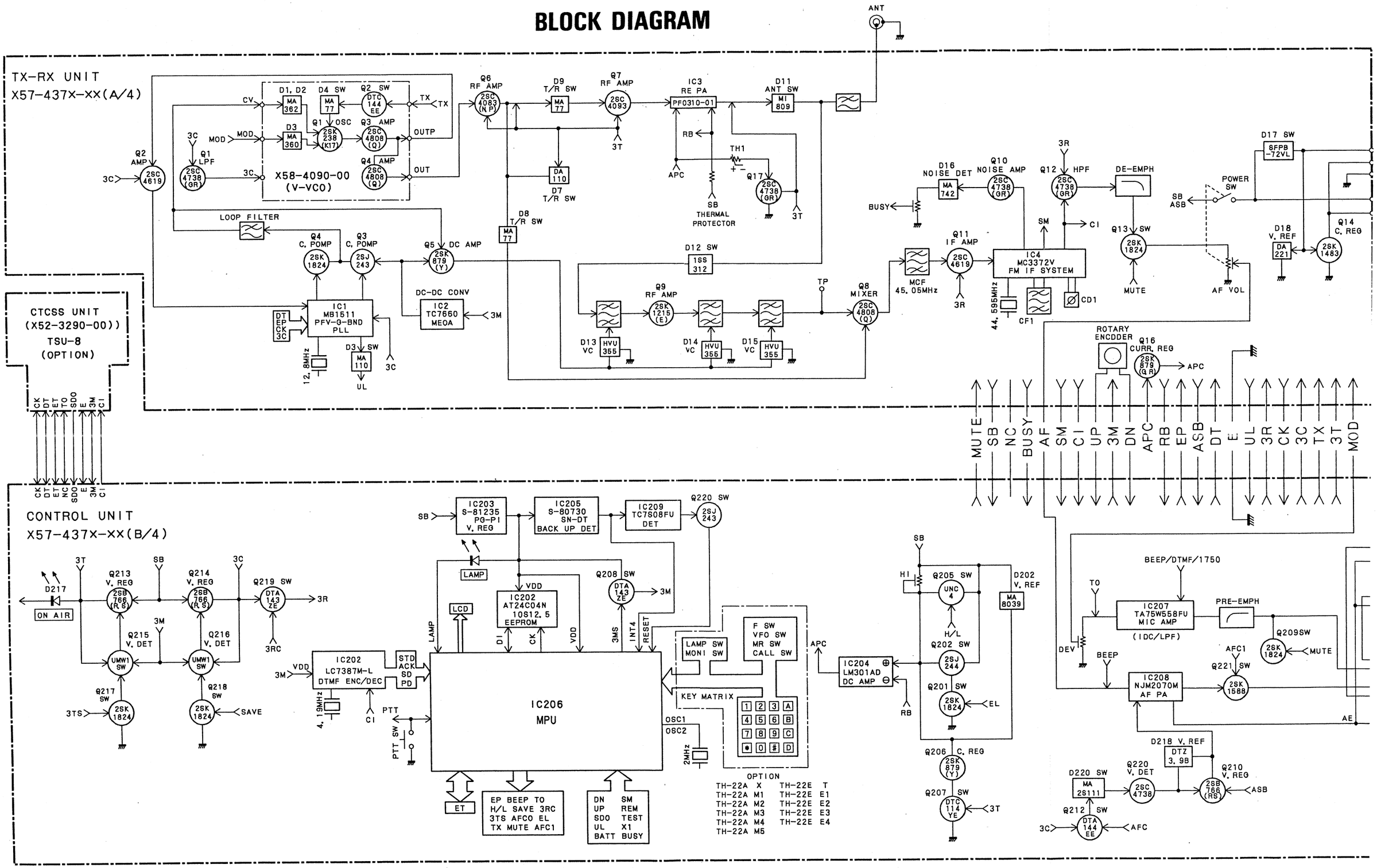
(A/4)

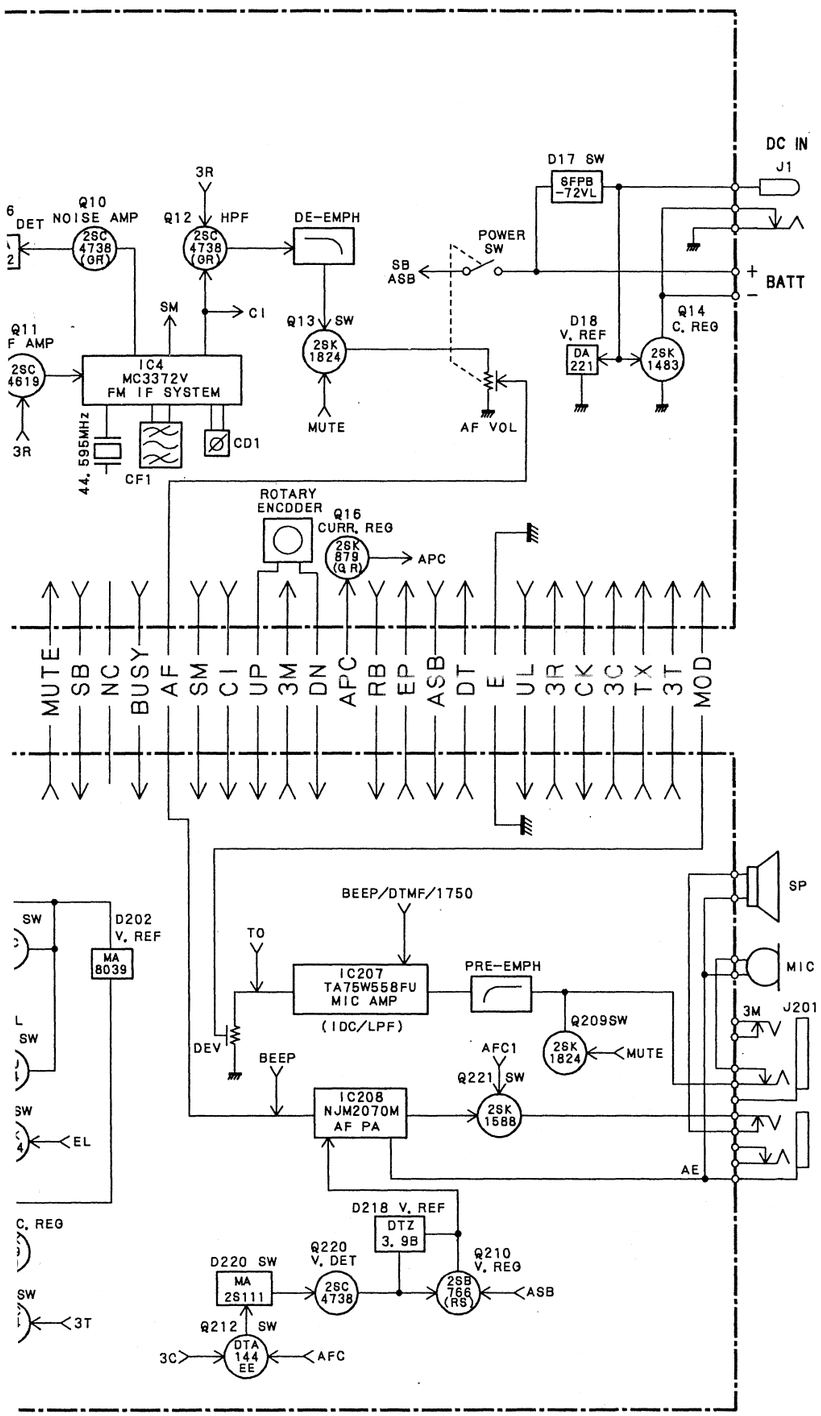
IC1	:MB1511PFV-G-BND
IC2	:TC7660MEOA
IC3	:PF0310-01
IC4	:MC3372V
Q1, 10, 12, 15	:2SC4738(GR)
Q2, 11	:2SC4619
Q3	:2SJ243
Q4, 13	:2SK1824
Q5	:2SK879(Y)
Q6	:2SC4083(N, P)
Q7	:2SC4093
Q8	:2SC4808(Q)
Q9	:2SK1215(E)
Q14	:2SD1483
Q16	:2SK879(GR)
D1, 3	:MA2S111
D4	:MA728
D5, 18	:DA221
D7	:MA110
D8, 9	:MA77
D11	:MI809
D12	:1SS312
D13-15	:HVU355
D16	:MA742
D17	:SFPB-72VL
D20	:MA8062

(B/4)

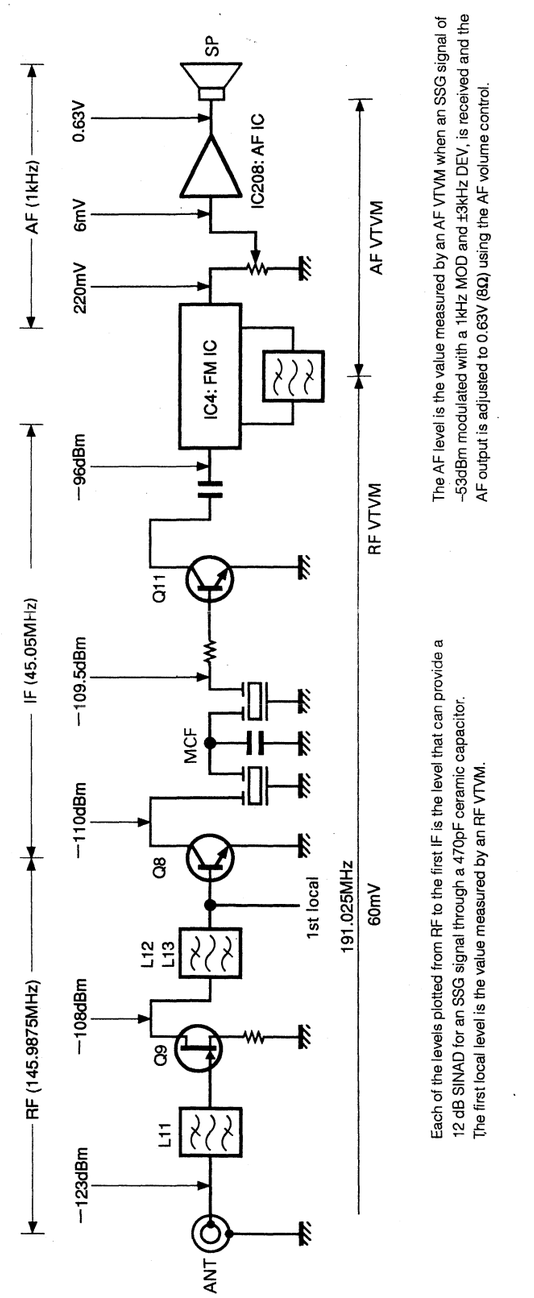
IC201	:LC7387M-L
IC202	:AT24C04N10SI2.5
IC203	:S-81235PG-PI
IC204	:LM301AD
IC205	:S-8073SN-DT
IC206	:HD404629B17TF
IC207	:TA75W558FU
IC208	:NJM2070M
IC209	:TC7S08FU
Q201, 209, 217, 218	:2SK1824
Q202, 220	:2SJ243
Q203	:DTA114EU
Q205	:UMC4
Q206	:2SK879(Y)
Q207	:DTC114YE
Q208, 219	:DTA143ZE
Q210, 213, 214	:2SB766(R, S)
Q211	:2SC4738(GR)
Q212	:DTA144EE
Q215, 216	:UMW1
Q221	:2SK1588
D202	:MA8039
D204, D205	:B30-2116-05
D206-213	:MA110
D215	:HN2D01FU
D216, 220	:MA2S111
D217	:B30-2115-05
D218	:DTZ3.9(B)

BLOCK DIAGRAM





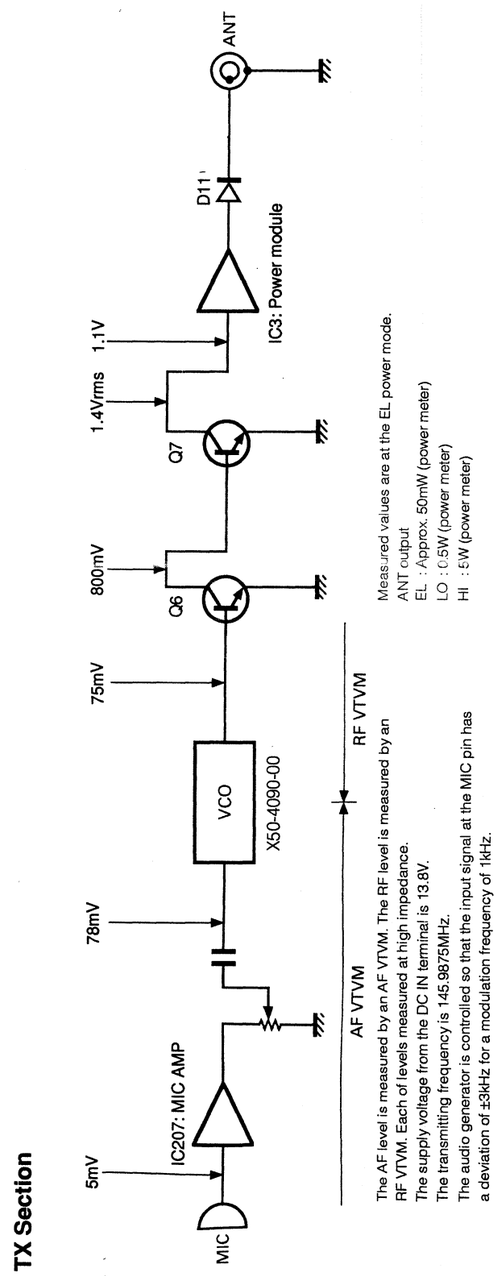
LEVEL DIAGRAM



Each of the levels plotted from RF to the first IF is the level that can provide a 12 dB SINAD for an SSG signal through a 470pF ceramic capacitor.
The first local level is the value measured by an RF VTVM.

The AF level is the value measured by an AF VTVM when an SSG signal of –53dBm modulated with a 1kHz MOD and ±3kHz DEV, is received and the AF output is adjusted to 0.63V (8Ω) using the AF volume control.

RX Section



Measured values are at the EL power mode.
ANT output
EL : Approx. 50mW (power meter)
LO : 0.5W (power meter)
HI : 5W (power meter)

The AF level is measured by an AF VTVM. The RF level is measured by an RF VTVM. Each of levels measured at high impedance.
The supply voltage from the DC IN terminal is 13.8V.
The transmitting frequency is 145.9875MHz.
The audio generator is controlled so that the input signal at the MIC pin has a deviation of ±3kHz for a modulation frequency of 1kHz.

TX Section

DTP-2 (DTMF

BT-9 (BATTERY CA

DTP-2 DTMF Key pad External

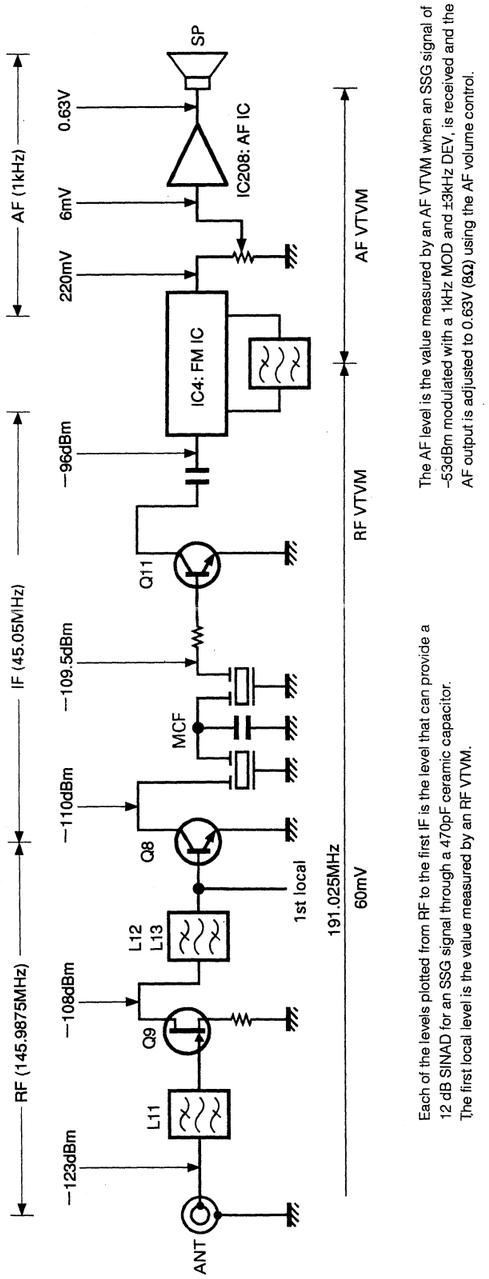
BC-17 Electrical Characteristic

Charging System 0
(Chargir
Voltage .....
Capacity .....
Charging time ..... Approx. 15
Approx. 30

BT-9 External View

LEVEL DIAGRAM

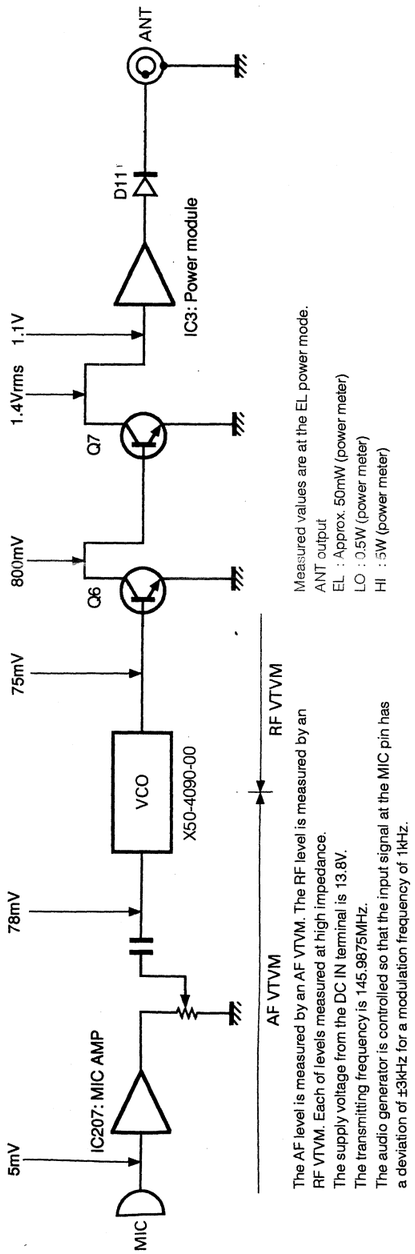
RX Section



The AF level is the value measured by an AF VTVM when an SSG signal of −53dBm modulated with a 1kHz MOD and ±3kHz DEV, is received and the AF output is adjusted to 0.63V (8Ω) using the AF volume control.

Each of the levels plotted from RF to the first IF is the level that can provide a 12 dB SINAD for an SSG signal through a 470pF ceramic capacitor.
The first local level is the value measured by an RF VTVM.

TX Section



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The AF level is measured by an AF VTVM. The RF level is measured by an RF VTVM. Each of levels measured at high impedance.
The supply voltage from the DC IN terminal is 13.8V.
The transmitting frequency is 145.9875MHz.
The audio generator is controlled so that the input signal at the MIC pin has a deviation of ±3kHz for a modulation frequency of 1kHz.

TH-22A/AT/E

DTP-2 (DTMF KEY PAD) / BC-17 (WALL CHARGER) / BT-9 (BATTERY CASE) / PB-30,32 (STANDARD BATTERY PACK)

DTP-2 DTMF Key pad External View

BC-17 Electrical Characteristics

Charging System	0.1C normal charging (Charging through main unit)
Voltage	DC 13.5V
Capacity	75 mA
Charging time	Approx. 15 hours (PB-30/32/34) Approx. 30 hours (PB-33)

BC-17 External View

BT-9 External View

PB-30 External View

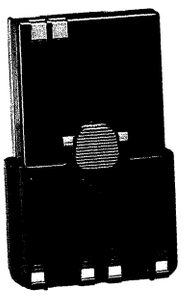
4.8V 600mAh

PB-32 External View

6V 600mAh

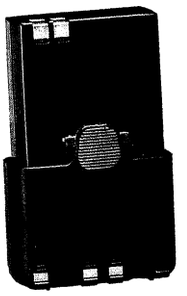
PB-33 (LONG LIFE BATTERY PACK)/ PB-34 (HIGH POWER BATTERY PACK) / SC-37, 38, 39, 40 (SOFT CASE)

PB-33 External View



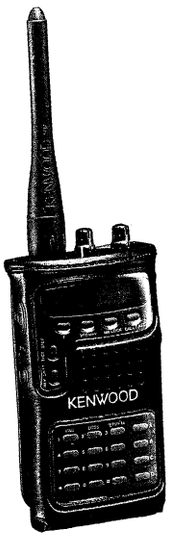
6V 1200mAh

PB-34 External View



9.6V 600mAh

SC-37 External View
(for PB-30 & 32)



Size S

SC-38 External View
(for PB-30 & BT-9)

Size M

SC-39 External View
(for PB-33 & 34)

Size L

SC-40 External View
(with Shoulder Belt)

Size General

TH-22A/AT/E

SPECIFICATIONS

GENERAL

Frequency range (MHz)	
U.S./Canada	144 to 148
Europe	144 to 146
Australia	144 to 148
General market	144 to 148 [1]
Mode	F2, F3 (FM)
Usable temperature range	–20°C to +60°C (–4°F to +140°F)
Rated voltage	
External power supply (DC IN)	5.0 to 16.0 V DC (13.8 V DC)
Battery terminals	4.0 to 15.0 V DC (6.0V DC)
Current drain (Approx.)	
Receive with no signal (Average)	45 mA
Battery Saver ON	15 mA
Transmit with H, 13.8V DC (Ext. power supply)	1.3 A
Transmit with H, 6.0V DC (Battery)	1.3 A
Transmit with L, 6.0V DC (Battery)	0.5 A
Transmit with EL, 6.0V DC (Battery)	250 mA
Grounding method	Negative ground
Dimensions (WxHxD)	56 × 116.5 × 24.5 mm
Dimensions (projections included)	65 × 130.5 × 29.8 mm
Weight[2](Approx.)	290 g
Microphone impedance	2 kΩ
Antenna impedance	50 Ω

TRANSMITTER

Power output (Approx.)	
H, 13.8 V	5 W
H, 6.0 V	3 W
L, 6.0 V	0.5 W
EL, 6.0 V	30 mW
Modulation	Reactance
Maxmimum frequency deviation	±3.5 kHz to ±5 kHz
Spurious emissions	–60 dB or less

RECEIVER

Circuitry	Double conversion superheterodyne
1st intermediate frequency	45.05 MHz
2nd intermediate frequency	455 kHz
Sensitivity (12 dB SINAD)	–16 dBμ 0.16 μV or less
Squelch sensitivity	–20 dBμ (0.1 μV) or less
Selectivity	
–6 dB	12 kHz or more
–40 dB	28 kHz or less
Audio output (10 % distortion)	200 mW or higher (8 Ω load)

[1] Some versions have reduced RX and TX range: 144 to 146 MHz.
[2] Antenna, hand strap, belt hook, and PB-32 included.

KENWOOD CORPORATION
Alive Mitake, 2-5, Shibuya 1-chome, Shibuya-ku, Tokyo 150, Japan

KENWOOD SERVICE CORPORATION
P.O. BOX 22745, 2201 East Dominguez Street, Long Beach, CA 90801-5745, U.S.A.

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

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

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

TRIO-KENWOOD U.K. LIMITED
KENWOOD House, Dwight Road, Watford, Herts., WD1 8EB United Kingdom

KENWOOD ELECTRONICS NEDERLAND B.V.
Amsterdamseweg 35, 1422 AC Uithoorn, The Netherlands

KENWOOD ELECTRONICS ITALIA S.p.A.
Via G. Sirtori, 7/9 20129 Milano, Italy

KENWOOD ESPAÑA S.A.
Bolivia, 239-08020 Barcelona, Spain

KENWOOD ELECTRONICS AUSTRALIA PTY. LTD.
(A.C.N. 001 499 074)
P.O. Box 504, 8 Figtree Drive, Australia Centre, Homebush, N.S.W. 2140, Australia

KENWOOD & LEE ELECTRONICS, LTD.
Unit 3712-3724, Level 37, Tower one Metroplaza, 223 Hing Fong Road, Kwai Fong, N.T., Hong Kong

KENWOOD ELECTRONICS CANADA INC.
6070 Kestrel Road, Mississauga, Ontario, Canada L5T 1S8