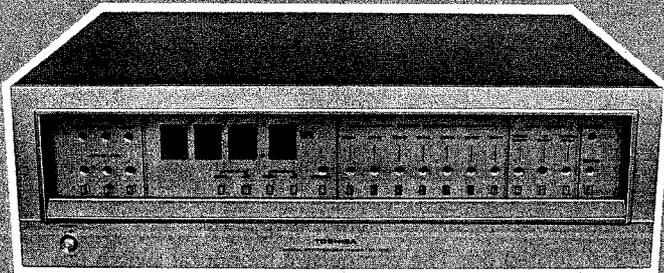


TOSHIBA

FM DIGITAL SYNTHESIZER TUNER

ST-910



SPECIFICATIONS

CIRCUIT SYSTEM

PLL frequency synthesizer system using the quartz crystal oscillator.
 High performance Front-End using 6-channel varicap diodes.
 Stereo demodulation circuit using the PLL ICs.

SEMICONDUCTORS

Transistor:	32
FET:	9
Diode:	100
IC:	linear 11 digital 85
LED:	24

TUNER SECTION

Frequency Range:	87.5 ~ 107.9 MHz
Usable Sensitivity (IHF):	1.8 μ V
Distortion Factor:	MONO 0.15% (400 Hz, 100%) STEREO 0.2% (400 Hz, 100%)
S/N Ratio:	75 dB
Frequency Response:	20 Hz ~ 15 kHz, \pm 0.5 dB
Selectivity (IHF):	85 dB
Image Rejection Ratio:	100 dB

IF Rejection Ratio:	100 dB
Capture Ratio:	1.5 dB
Spurious Ratio:	100 dB
AM Suppression Ratio:	65 dB
FM Stereo Separation:	40 dB (1 kHz)
Rated Power Output:	FIXED 650 mV (400 Hz, 100%) VARIABLE 0 ~ 2.0 V (400 Hz, 100%)
Output Impedance:	1 k Ω (at the maximum power input)
Antenna Input:	300 Ω BALANCE 75 Ω UNBALANCE
Muting:	20 dB, 40 dB, 60 dB

POWER SOURCE AND OTHERS

Power Source:	AC100/120/220/240 V 50/60 Hz
Power Consumption:	30 W
Dimensions:	450 mm (W) \times 135 mm (H) \times 340 mm (D) (17 ²³ / ₃₂ " \times 5 ⁵ / ₁₆ " \times 13 ¹³ / ₃₂ ")
Weight:	8 kg (17 lbs)

ACCESSORIES

FM feeder antenna, FM coaxial connector, connecting cords, silicon cloth, felt pad, Owner's manual.

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1. OPERATING CONTROLS

1-1. FRONT VIEW

③ SIGNAL LEVEL indicators

These indicators are used to indicate the signal level as follows;
 No Indicator is put on under 20 dB
 One Indicator is put on beyond 20 dB
 Two Indicators are put on beyond 40 dB
 Three Indicators are put on beyond 60 dB

② MUTING LEVEL switches

You can use it when changing the sensitivity of the automatic tuning operation. There are three levels. By touching the switch, you can select the following levels.

MUTING LEVEL 1 beyond 20 dB
 MUTING LEVEL 2 beyond 40 dB
 MUTING LEVEL 3 beyond 60 dB
 When the radio waves have not enough level to reach the muting level, the automatic tuning operation should not be operated. The same situation is occurred when choosing the Manual or Preset tuning operation. When touching the switch of MUTING LEVEL 1 and the green indicator lamp is turned off, the muting operation is not operated. The Manual or Preset tuning operation is chosen at that situation, the noise will be heard outside the broadcast frequency. When touching the switch of MUTING LEVEL 1 and the green indicator lamp is turned on, the muting operation is not operated. When Power Switch is turned on, the switch of Muting Level 1 is necessarily turned on. It has the function of ON/OFF operation and Muting operation can be released by using this switch.

④ Frequency displays

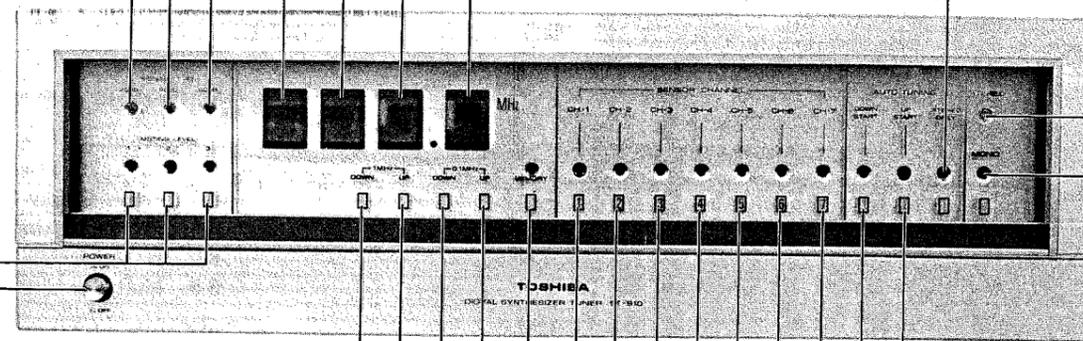
The frequency you chose is shown by digital number. Display figures are 100 MHz, 10 MHz, 1 MHz, 0.1 MHz.

⑨ STEREO ONLY STOP switch

This switch has the stop operation only at the stereo broadcasts. Its operation can be released by operating the compulsive monoural switch as explained at 10.

⑩ Compulsive MONOURAL switch

This switch has the operation of changing stereo source to manoural compulsively. You can use this switch when you want to record the stereo broadcast having much noise to listen.



① Power switch

Push the button, Power Supply is put on. Push it once more, it is put off.

⑤ Manual TUNING switches

By touching this switch (UP or DOWN), you can change the receiving frequency with a 1 MHz or 0.1 MHz interval. Each step is sent by each touching.

⑦ MEMORY switches

This switch plays a role of the memorizing the received frequency by IC memory device. When touching this switch, the green indicator lamp is turned on and the device is under the memorization operation during about 3 seconds. You must touch one switch in SENSOR CHANNEL CH-1~CH-7, while the green indicator lamp is turned on and lighted brightly and put off. At the same time, the green indicator lamp of the SENSOR CHANNEL related to the switch you touch is lighted up. When you want to call the memorized and presetted frequency, you only touch the switch, you will be able to receive it easily. If you don't touch it during about 3 seconds, the memorization operation will be released. All corresponding pilot lamps go off when Power Switch is turned off, it means the received frequencies you chose are transferred to the CHO as the reserved broadcasting stations.

⑪ STEREO indicator

The STEREO indicator lamp is turned on when received broadcast is stereo source. But when the compulsive monoural switch is operated, this lamp is not turned on. The compulsive monoural switch can be released by touching the switch once more. This switching operation is necessarily released when Power Switch is turned off.

⑧ AUTO TUNING switches

By touching this switch, the frequency is increased (UP switch) or decreased (DOWN switch) and its operation is stopped when it accordes one of the broadcast frequencies. If it reaches the maximum (107.9 MHz) or minimum (87.5 MHz) value, its operation is reversed. When you want to choose the automatic tuning operation, pay attention to the things as follows;

- a. If receiving signal level does not reach beyond the input level, the tuning operation cannot be stopped.
- b. As explained at 9, you can use this switch only for stereo broadcasts.

Corresponding pilot lamp is lighted during operation and goes off when scanning operation is stopped.

1-2. REAR VIEW

⑬ MPX OUT terminal

When FM broadcasts by 4 channel will be started, you can enjoy the 4 channel broadcasts by using the adapter.

⑭ OUTPUT terminals

There are two terminals as follows;
 FIXED connected to LINE IN terminals of the Tape Deck and so on.
 VARIABLE .. connected to the terminals of Amplifire using attached code. It should be connected the L and R compatible to each set.

⑮ Remote control terminal

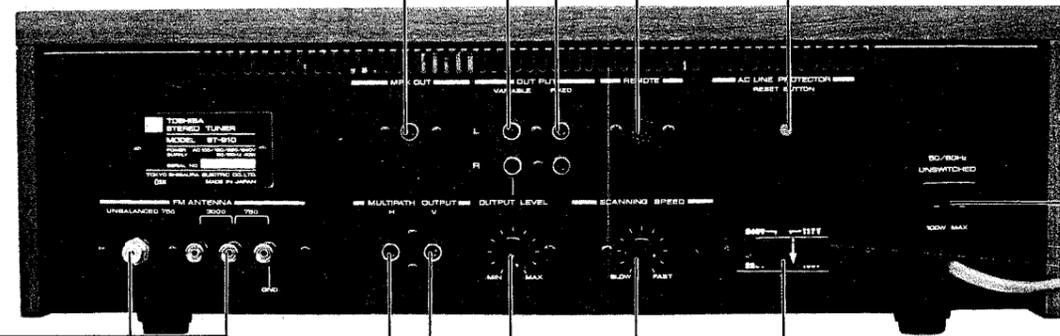
You can enjoy controlling this set remotely by using remote control unit offered by TOSHIBA.

⑰ AC LINE PROTECTOR RESET BUTTON

This button is used to cut an electric current from the Power Supply when an electric current to the circuit is overflowed. At the same time, the red button is broken out from Rear panel. When it is operated by unknown origin, contact your serviceman. After tracing it and repairing it, the red button is pushed. Power Supply will be put on.

⑫ FM antenna terminals

This set has two terminals for 75Ω coaxial cable and for 300Ω feeder cable. Both cable can be used, but you must avoid connecting two cables at the same time.



⑳ AC Spare Receptacle

This Receptacle supply AC 100/120/220/240 V independent of Power Supply switch of this set. Please enjoy this Receptacle to use for Power Supply of another set, Tape Deck, Record Player and so on. But the Power consumption of these sets should be limited under 100W.

⑯ MULTIPASS OUTPUT terminals

They are used to find the most suitable location of the antenna by using the oscilloscope as explained at another page.

⑰ OUTPUT LEVEL control knob

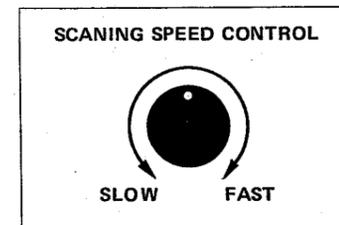
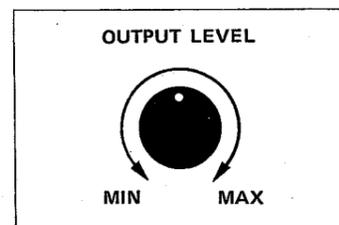
This knob is used to adjust the output level of VARIABLE output terminal. Right turning of the knob increases output level. Left turning decreases it and full turning of it indicates zero output level.

⑱ SCANNING SPEED control knob

This knob is used to vary the speed of the automatic tuning operation. Right turning fully of the knob indicates maximum speed, 2~3 times/sec at a 0.1 MHz unit. Left turning fully of the knob indicates minimum speed, 20~30 times/sec at a 0.1 MHz unit.

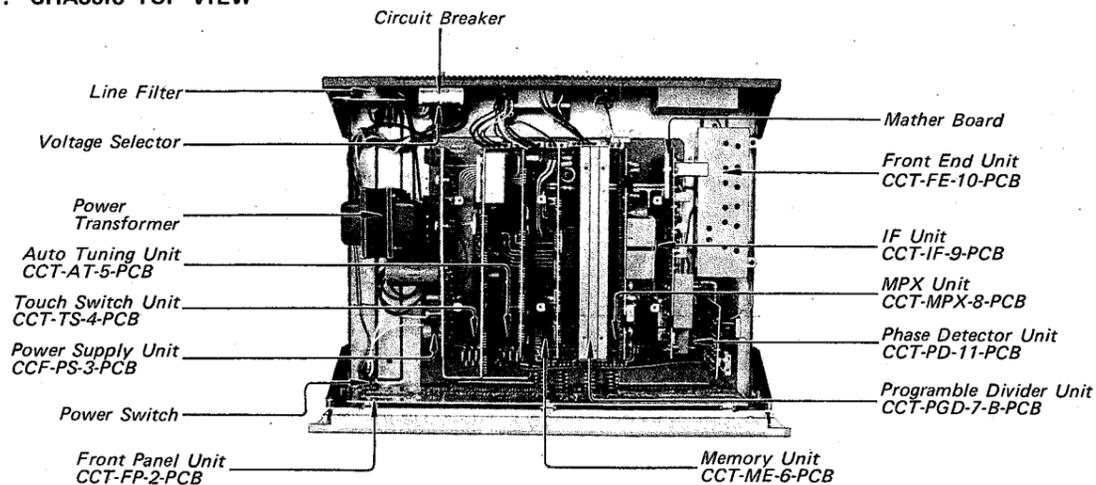
㉑ Power Supply voltage selector

We adjust your set's selector for your local power line voltage. Available power supply voltages are as follows; 100 V/120 V/220 V/240 V. However, we adjusted your ST-910 selector for your local power line voltage. In case you want to use your ST-910 in the different voltage area, please contact your local dealer.



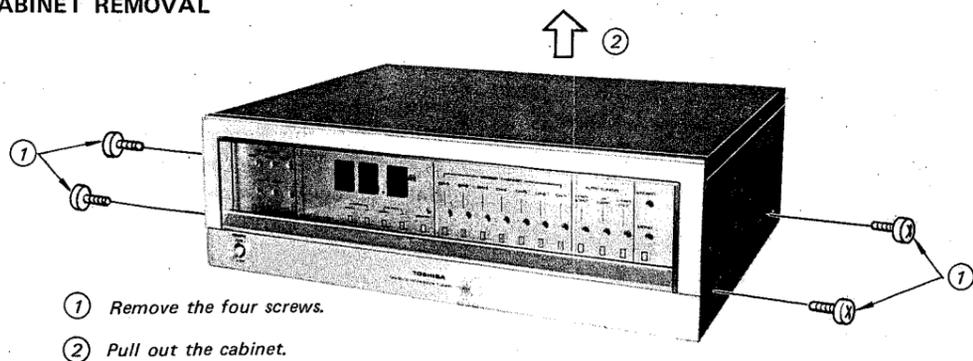
2. PARTS LOCATION

2-1. CHASSIS TOP VIEW

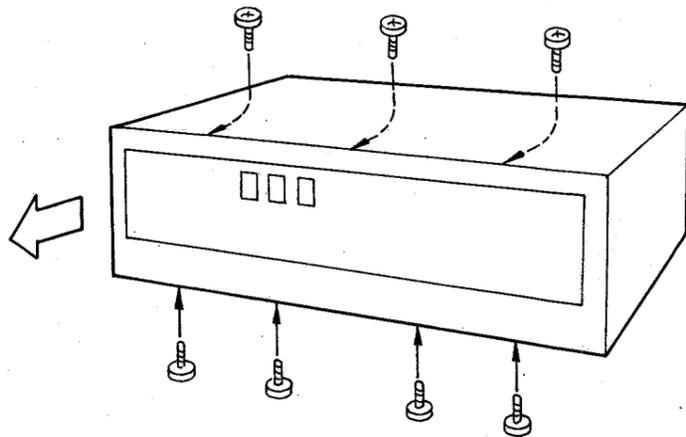


3. DISASSEMBLY INSTRUCTION

3-1. CABINET REMOVAL

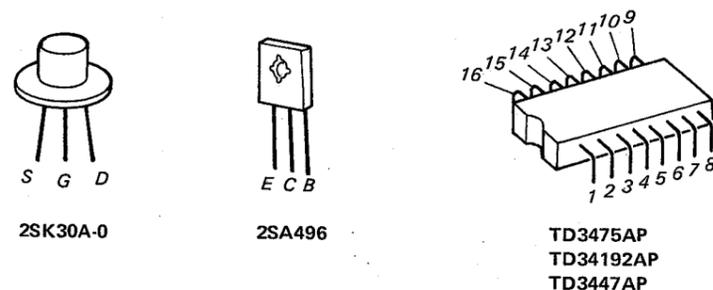
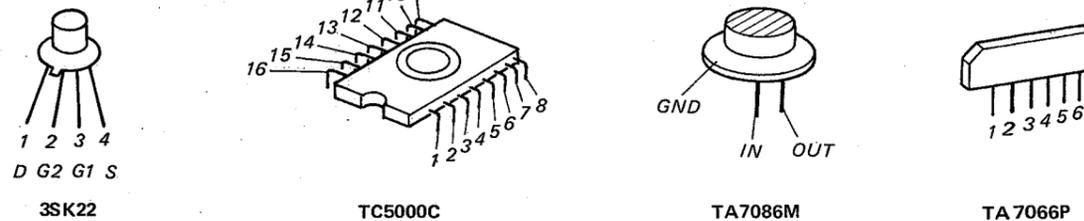
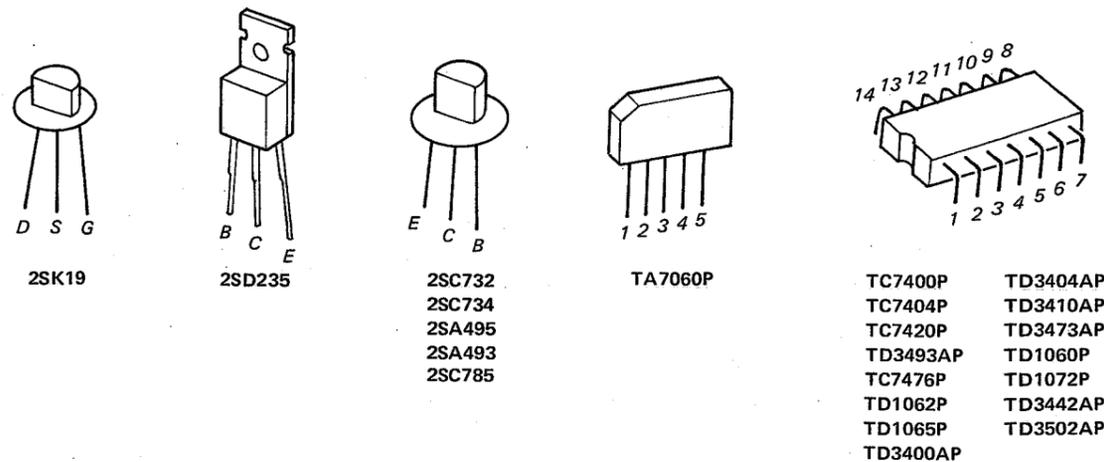


3-2. FRONT PANEL REMOVAL

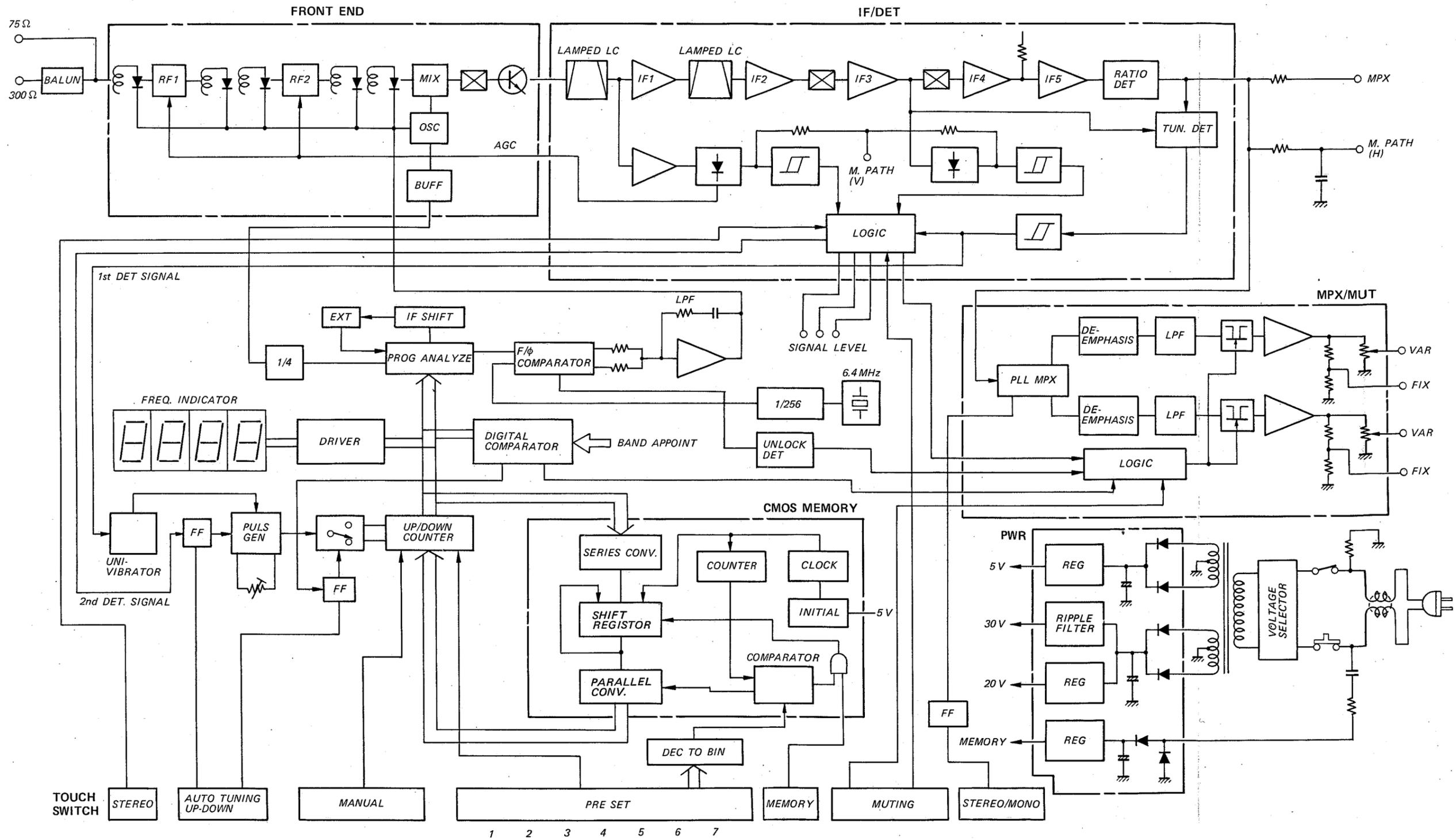


- Remove the cabinet.
- Removal the seven screws.
- Pull out the panel.

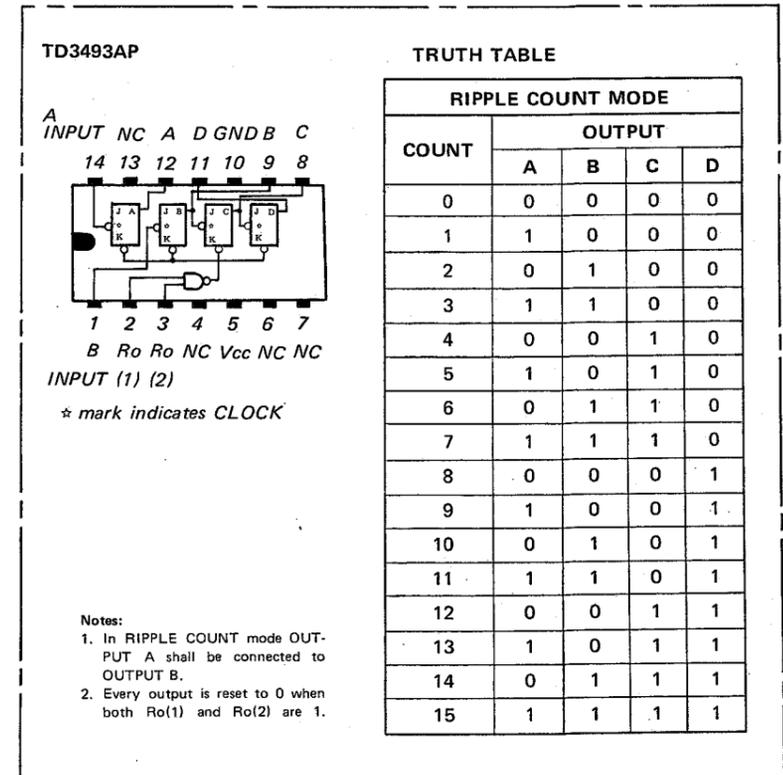
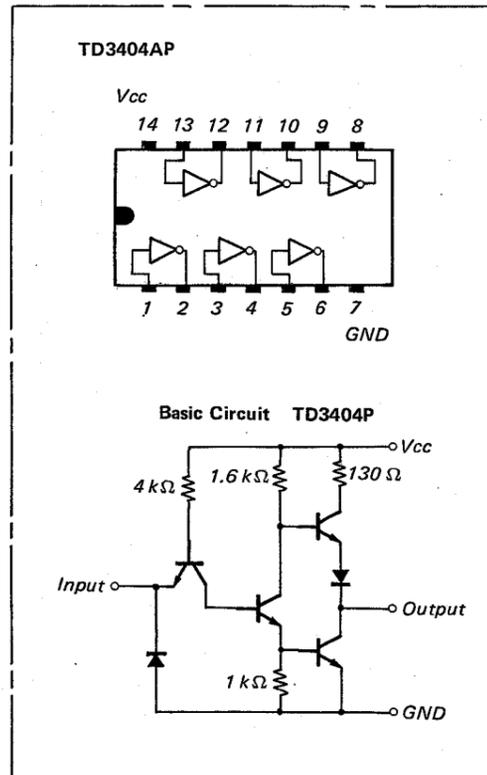
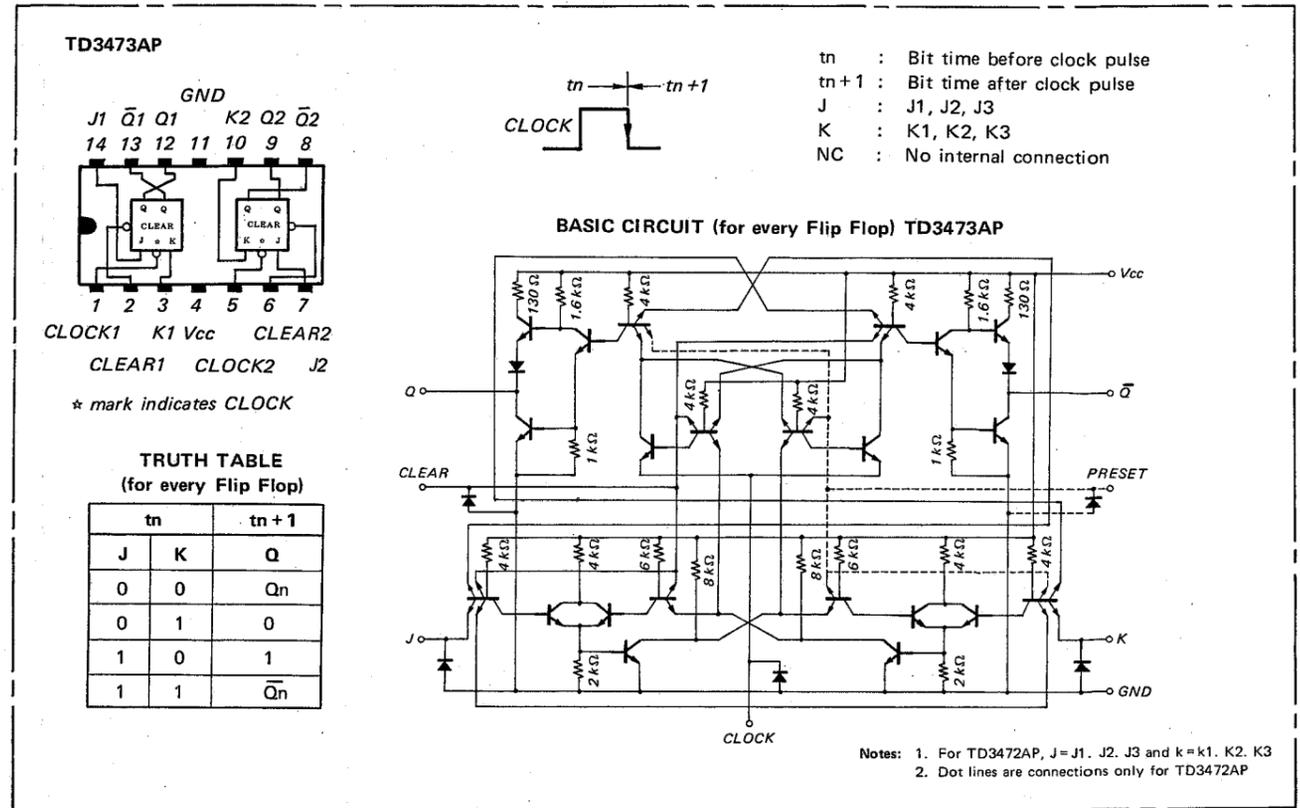
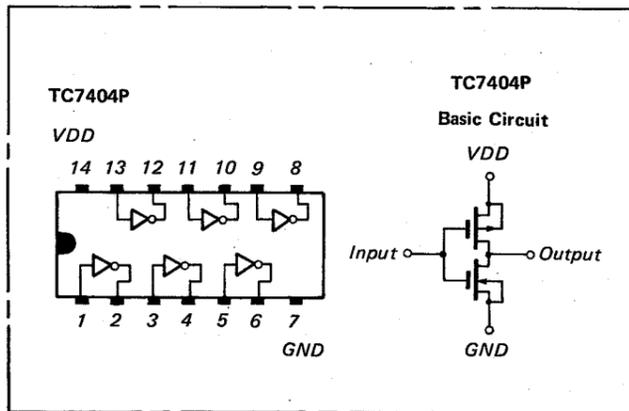
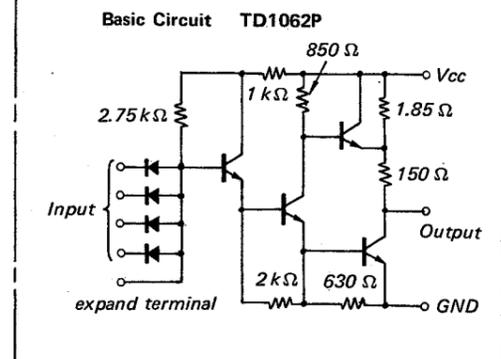
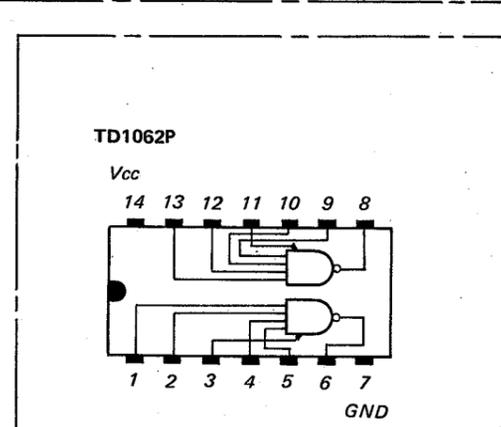
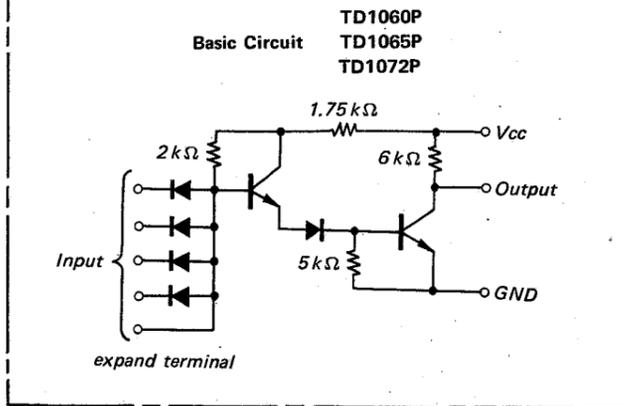
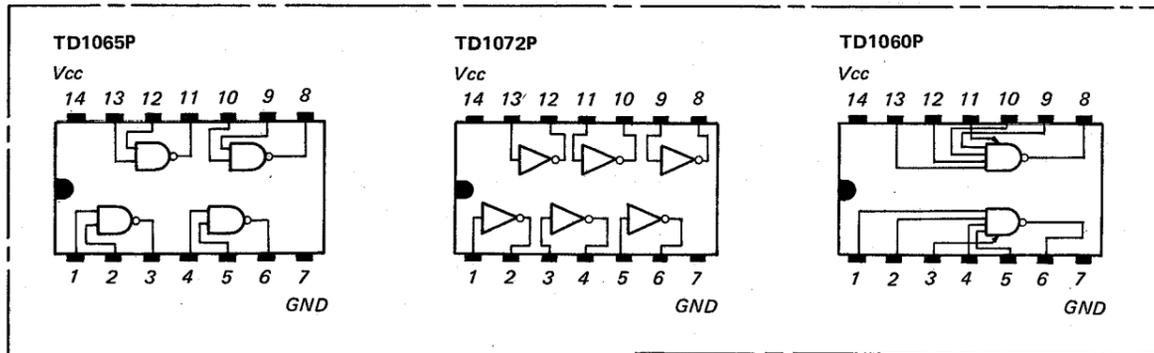
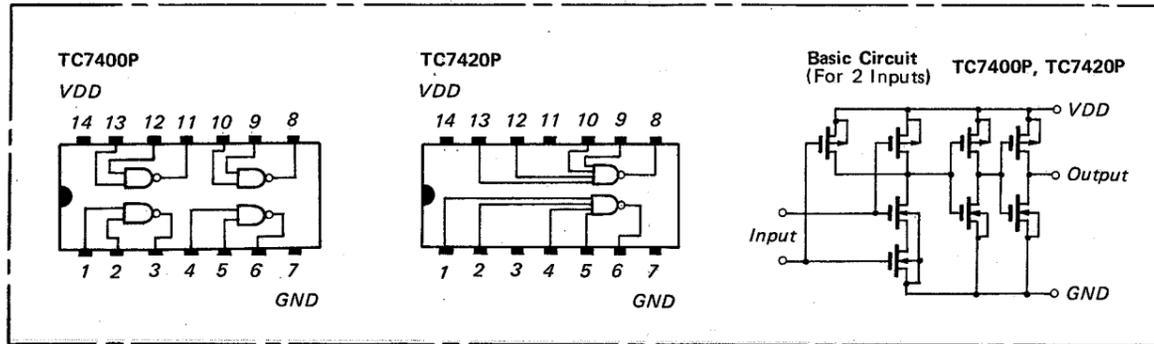
4. SEMICONDUCTOR BASE DIAGRAM



5. BLOCK DIAGRAM



6. INSIDE CONNECTION OF IC and TRUTH TABLE



TD3475AP

CLOCK 1, 2
Q1 Q2 Q̄2 GND Q3 Q3 Q4
16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8
Q1 D1 D2 Vcc D3 D4 Q4
CLOCK 3, 4

LOGIC DIAGRAM (for every LATCH)

To Other Latch
CLOCK DATA

TRUTH TABLE

tn	tn + 1	tn + 1
D	Q	Q
1	1	0
0	0	1

tn : Bit time before clock pulse
tn + 1 : Bit time after clock pulse

This truth table shows the output when clock pulse changes from 0 to 1. When clock pulse is 1, Q changes according to D. After clock pulse reverts to 0, Q holds state of D before the reversion.

TC5000C

Vdd
16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8
1 DATA INPUT1
1 DATA INPUT2
1 INPUT MODE
1 OUTPUT MODE
1 DATA OUTPUT
1 DATA OUTPUT
1 CLOCK
NC
GND

LOGIC DIAGRAM
(½ of Device Shown)

DATA INPUT1
DATA INPUT2
INPUT MODE
CLOCK
OUTPUT MODE
DATA OUTPUT
(TTL COMPATIBLE BUFFER)

TD34192AP

Vcc
16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8
B IN
B OUT
A OUT
DOWN COUNT
UP COUNT
C OUT
D OUT
GND

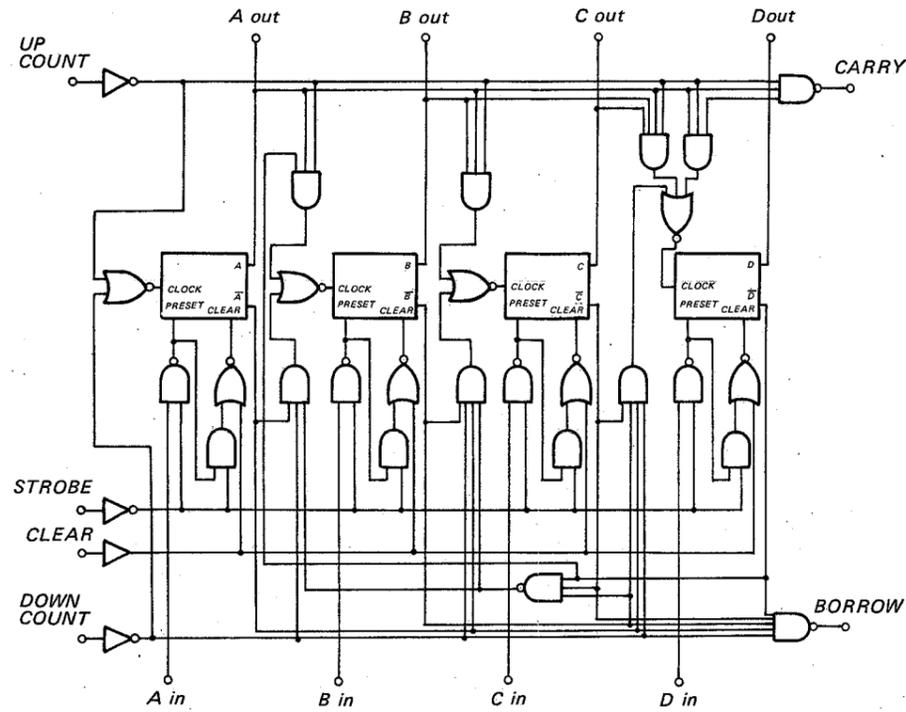
TIMING CHART

TRUTH TABLE TD34192AP

COUNT-UP PULSE	COUNT-DOWN PULSE	INPUT tn				OUTPUT tn + 1							
		STROBE	CLEAR	INPUT				OUTPUT				BORROW	CARRY
				A	B	C	D	A	B	C	D		
*	*	0	0	A IN	B IN	C IN	D IN	A IN	B IN	C IN	D IN	Note 1	Note 1
*	*	0	0	1	0	0	1	1	0	0	1	Note 1	Note 1
*	*	*	1	*	*	*	*	0	0	0	0	Note 1	Note 1
1	1	1	0	*	*	*	*	1	0	0	0	1	1
2	1	1	0	*	*	*	*	0	1	0	0	1	1
3	1	1	0	*	*	*	*	1	1	0	0	1	1
4	1	1	0	*	*	*	*	0	0	1	0	1	1
5	1	1	0	*	*	*	*	1	0	1	0	1	1
6	1	1	0	*	*	*	*	0	1	1	0	1	1
7	1	1	0	*	*	*	*	1	1	1	0	1	1
8	1	1	0	*	*	*	*	0	0	0	1	1	1
9	1	1	0	*	*	*	*	1	0	0	1	1	0
0	1	1	0	*	*	*	*	0	0	0	0	1	1
1	1	1	0	*	*	*	*	1	0	0	0	1	1
‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡
8	1	1	0	*	*	*	*	0	0	0	1	1	1
9	1	1	0	*	*	*	*	1	0	0	1	1	1
1	8	1	0	*	*	*	*	0	0	0	1	1	1
1	7	1	0	*	*	*	*	1	1	1	0	1	1
1	6	1	0	*	*	*	*	0	1	1	0	1	1
‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡
1	1	1	0	*	*	*	*	1	0	0	0	1	1
1	0	1	0	*	*	*	*	0	0	0	0	0	1
1	9	1	0	*	*	*	*	1	0	0	1	1	1

- Notes: 1. BORROW output and CARRY output depend on A, B, C, and D output DOWN COUNT and UP COUNT inputs.
2. *: 0 or 1
3. tn: Bit time before CLOCK input changes from 0 to 1.
4. tn + 1: Bit time after CLOCK input changes from 0 to 1.

LOGIC DIAGRAM TD-34192AP



Explanations for operation:

1. UP-COUNT operation

ABCD outputs (Aout, Bout, Cout and Dout) depend on the rise-up of counting pulse which is fed to UP-COUNT input when DOWN-COUNT input is 1, CLEAR input is 0 and STROBE input is 1. UP-COUNT input pulse of negative polarity appears on CARRY output terminal when BCD outputs change from 9 (Aout=1, Bout=0, Cout=0, Dout=1) to 0 (Aout=0, Bout=0, Cout=0, Dout=1).

2. DOWN-COUNT operation

ABCD outputs depend on the rise-up of counting pulse which is fed to DOWN-COUNT input when UP-COUNT input is 1, CLEAR input is 0 and STROBE input is 1.

DOWN-COUNT input pulse of negative polarity appears on BORROW output terminal when BCD outputs change from 0 to 9.

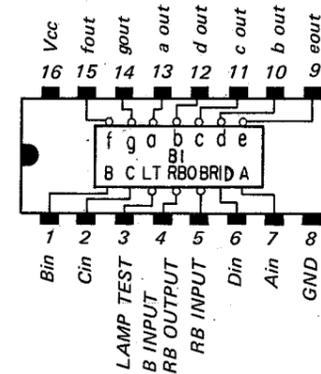
3. PRESET operation

When STROBE input is reset to 0 under the condition that CLEAR input is 0, Ain, Bin, Cin and Din inputs are transferred to Aout, Bout, Cout and Dout respectively and put in memory. When STROBE input is set to 1, PRESET inputs of Ain, Bin, Cin and Din are shut out. This operation with COUNT operation enables counting from any state.

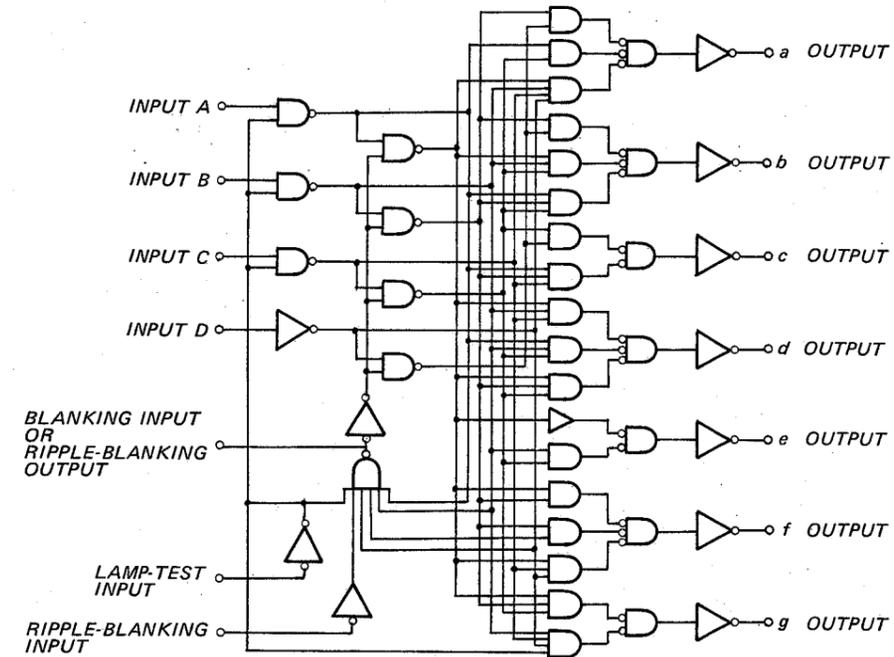
4. RESET operation

When CLEAR input is set to 1, Aout, Bout, Cout and Dout are reset to 0.

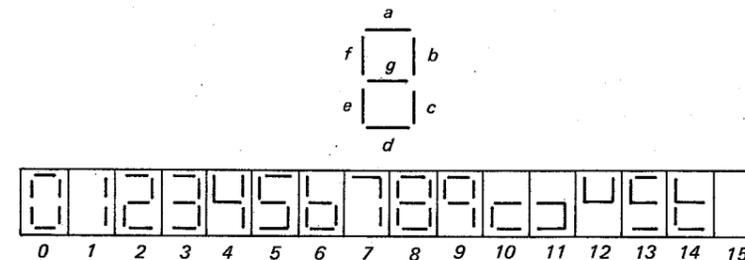
TD3447AP



LOGIC DIAGRAM TD3447AP



Number indication form



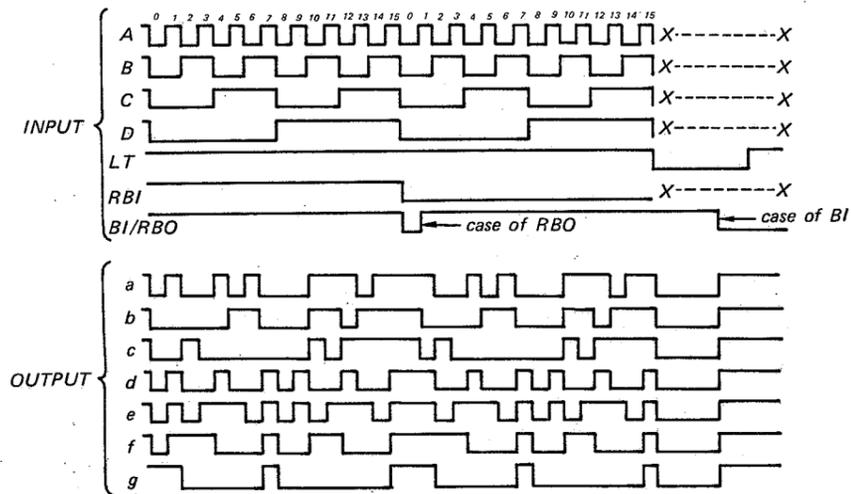
TRUTH TABLE TD-3447AP

FUNCTION	INPUT						OUTPUT							NOTE	
	LT	RBI	D	C	B	A	BI/RBO	a	b	c	d	e	f		g
0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1
1	1	x	0	0	0	1	1	1	0	0	1	1	1	1	1
2	1	x	0	0	1	0	1	0	0	1	0	0	1	0	
3	1	x	0	0	1	1	1	0	0	0	0	1	1	0	
4	1	x	0	1	0	0	1	1	0	0	1	1	0	0	
5	1	x	0	1	0	1	1	0	1	0	0	1	0	0	
6	1	x	0	1	1	0	1	1	1	0	0	0	0	0	
7	1	x	0	1	1	1	1	0	0	0	1	1	1	1	
8	1	x	1	0	0	0	1	0	0	0	0	0	0	0	
9	1	x	1	0	0	1	1	0	0	0	1	1	0	0	
10	1	x	1	0	1	0	1	1	1	1	0	0	1	0	
11	1	x	1	0	1	1	1	1	1	0	0	1	1	0	
12	1	x	1	1	0	0	1	1	0	1	1	1	0	0	
13	1	x	1	1	0	1	1	0	1	1	0	1	0	0	
14	1	x	1	1	1	0	1	1	1	1	0	0	0	0	
15	1	x	1	1	1	1	1	1	1	1	1	1	1	1	
BI	x	x	x	x	x	x	0	1	1	1	1	1	1	1	2
RBI	1	0	0	0	0	0	0	1	1	1	1	1	1	1	3
LT	0	x	x	x	x	x	1	0	0	0	0	0	0	0	4

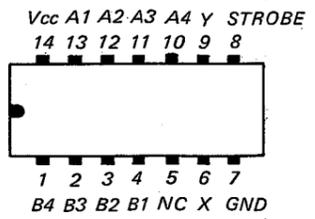
Notes:

1. Wired OR is available for BI/RBO (BI; BLANKING INPUT, RBO; RIPPLE-BLANKING OUTPUT). To drive seven-segment indication tube, this terminal shall be kept open or shall be 1.
To make indication of 0 in decimal number, RBI input shall be open or shall be 1.
Both 1 or 0 are acceptable for mark X in this truth table.
2. When BI input is 0, every segment output is set to 1 no matter what the other inputs are.
3. When RIPPLE-BLANKING INPUT (RBI) and data inputs A, B, C and D are 0, every segment output is set to 1 and RBO output is set to 0.
4. When BI/RBO input is 1 and LAMP-TEST INPUT (LT) is 0, every segment output is reset to 0.

TIMING CHART



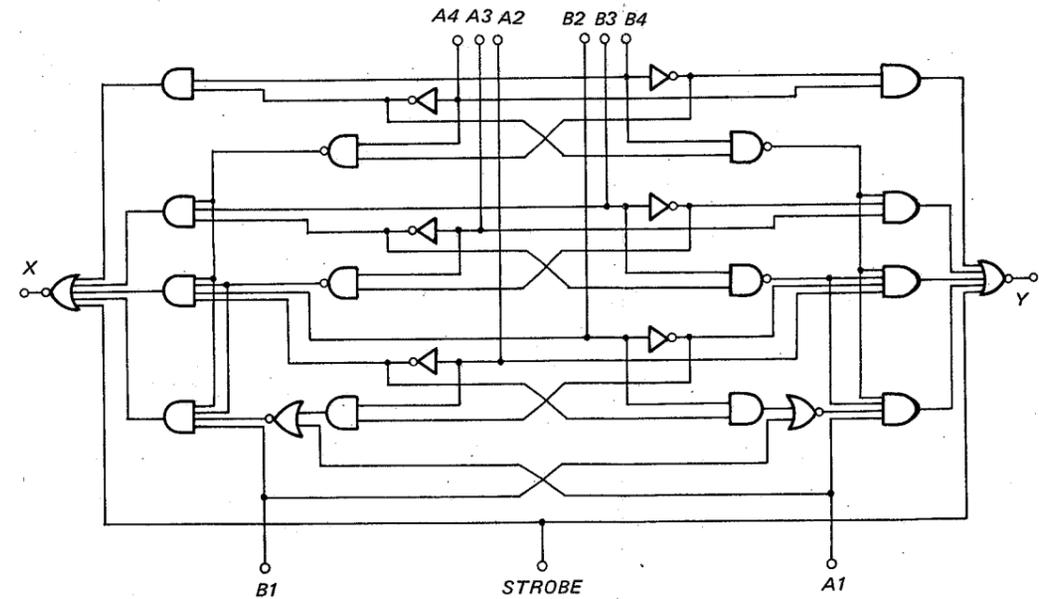
TD3502AP



TRUTH TABLE TD3502AP

NUMERICAL VALUE	INPUT					OUTPUT	
	A4	A3	A2	A1	STROBE	X	Y
A > B					0	1	0
A < B					0	0	1
A = B					0	1	1
A ≠ B					1	0	0

LOGIC DIAGRAM



7. PRINCIPLE OF DIGITAL CIRCUITS

Signals used in digital circuit are 0 and 1 only. Not only electronic computers but also various digital equipment such as measuring instruments and controllers work according to the combination of 0 and 1, as Morse code makes communication possible by means of only two signals of dots and dashes. Both Morse code and digital system have fixed rules using two signals or signs. The rules of digital systems to arrange combinations of 0 and 1 is called "Logic". No matter on how large a scale the digital equipment is, it is operated by the combination of only three logic circuits of OR (logical sum), AND (logical product) and NOT (negation). The reason why digital circuitry has seen highly developed is because of the introduction of integrated circuits due to the repeated use of these three simple circuits.

7-1. LOGIC

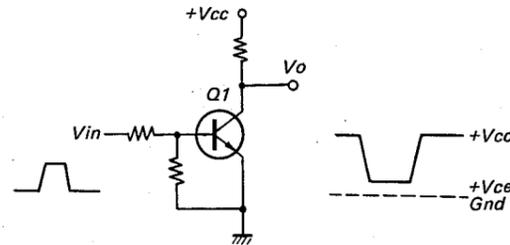
As forementioned, all information in digital circuitry is expressed by the combination of the two signs of 0 and 1. That is, digital systems must be formed by 0 and 1 only. Accordingly rules must be made what combination of 0 and 1 means what. This rule of the digital system is called "Logic", and the circuit based on the logic is called "Logical Operation Circuit" ("Logic Circuit" for short). "Logic" is not a special word for digital circuits. It comes from the science also called "Logic" which deals with the process of human thought and leads to the right conclusion. In logic, each matter (proposition) is judged true or false one by one, and right conclusion is reached. And logic has two standards of true and false is similar to digital circuits having two signs of 0 and 1. Thus the algebra of logic, which forms logic, applies to digital circuits.

The 1 and 0 are also called affirmation and negation, and symbolized A and \bar{A} . In digital circuit, anything can be used as circuit element, if there are two definitely distinguishable states, which can be externally controlled. Thus digital element is alternative and called "Two-level Logic". The following are the practical examples of two distinguishable states:

- Voltage is high or low at a point.
- Current flows into or out of a point.
- Transistor is on or off.
- Pulse is present or absent at a certain time.

The two states in circuits which will be mentioned hereinafter are that voltage is high or low at a point, in most cases. The definition which voltage will be 1 or 0 is free. It may be that high voltage is 1 and low voltage is 0, and vice versa. The important matter is to define which voltage is 1 or 0.

Taking a saturated inverter circuit as an example, as in Figure 8-1, when NPN transistor Q1 is off, its collector output voltage V_o is to the power supply voltage V_{cc} , and when on, the collector is saturated and the voltage $+V_{CE}(\text{sat}) (\approx Gnd)$. Therefore, the two states in this circuit are $+V_{cc}$ and $+V_{CE}(\text{sat})$, and either may be defined as 1 or 0.



Positive logic	Negative logic
logic 1	logic 0
logic 0	logic 1

Fig. 7-1. Positive logic and Negative logic

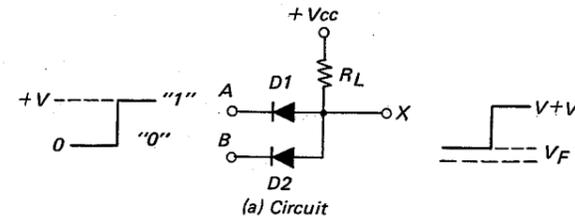
If the relatively high voltage is defined as 1, and the low voltage as 0, the logic is called "Positive Logic", and conversely if the relatively high voltage is 0, and the low Voltage is 1, it is called "Negative Logic".

Positive logic:	1 = +Vcc
	0 = +VCE (sat)
Negative logic:	1 = +VCE (sat)
	0 = +Vcc

To make up a digital system, the necessary logical functions are OR, AND, NOT and DELAY. But a delay circuit can be made with a flip flop circuit and a flip flop circuit can be made with the combination of the first three functions. Therefore, basic logical functions are OR, AND and NOT. The combination of these three makes every function possible.

(1) Logical product (AND)

A logical product circuit is called an AND circuit, or an AND gate. The example of an AND circuit is shown in Figure 8-2, in which voltage of 0(V) or +V(V) is applied to input and/or B. According to positive logic, 1 is +V(V) and 0 is 0(V). If 0(V) is applied to input A or B, or applied to both inputs, the connected diode D1 or D2, or both diodes will be conducting and the forward voltage drop of the diode which is almost equal to grounding potential is developed at output X. Only when +V(V) voltage is applied to both inputs, a high positive voltage +V is developed at the output.

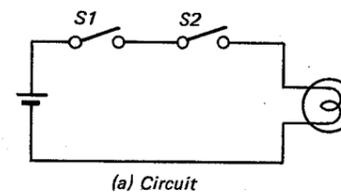


A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

(b) Truth table

Fig. 7-2. AND Circuit and Truth table

The table in Figure 8-2 shows the output for the combination of inputs A and B. Such a table that shows the relation of output and combination of inputs is called a "Truth Table". As in this truth table, only when all the inputs are 1, output is 1, this is logical product. The circuit shown in Figure 8-3 is a common to study the logical product, in which switches are connected in series.



(a) Circuit

S1	S2	L
0	0	0
1	0	0
0	1	0
1	1	1

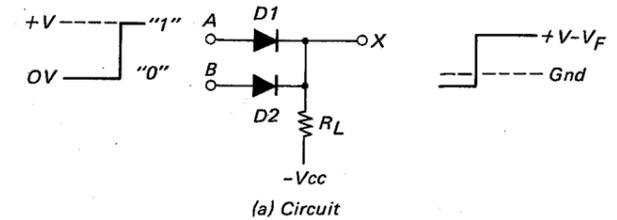
S = 1 = closed L = 1 = light-ON
 \bar{S} = 0 = open \bar{L} = 0 = light-OFF

(b) Truth table

Fig. 7-3. An example of AND circuit

The inputs are switches S1 and S2. Closed switches are defined as 1, and open switches as 0. The output is the lamp, and light-ON is defined as 1, and light-OFF as 0. Then all inputs must be 1 (switches are closed) to obtain an output of 1 (lamp lights). Therefore, the circuit of Figure 8-3 can be considered as an AND circuit. Switches S1, "AND" S2 must be closed to light the lamp.

A logical sum circuit is also called an OR circuit, or OR gate. Figure 8-4 is an example of it. By positive logic, when 1 = +V is applied to either of the inputs, for example, to input A as in Figure (a), diode D1 will conduct and at output X, +V voltage which is reduced by V_F (forward drop voltage of diode) is developed.

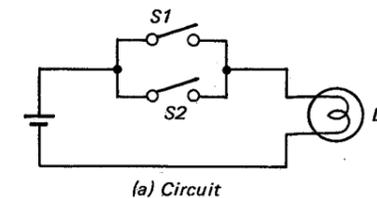


A	B	X
0	0	0
1	0	1
0	1	1
1	1	1

(b) Truth table

Fig. 7-4. OR Circuit

If, at this time, 0V is applied to input B, D2 is cut off by reverse bias and B is nothing to do with the output. As in truth table of (b), if either of the inputs A and B is 1, the output is 1, this is an OR circuit. Figure 8-5 is an example of OR circuit with switches. Switches are connected in parallel and to light lamp, one switch is enough to be closed. It is not necessary to close both switches. S1 "OR" S2 must be closed to light the lamp.



(a) Circuit

S1	S2	L
0	0	0
1	0	1
0	1	1
1	1	1

S = 1 = closed L = 1 = light-ON
 \bar{S} = 0 = open \bar{L} = 0 = light-OFF

(b) Truth table

Fig. 7-5. An example of OR Circuit

(3) Negation (NOT)

A negation circuit is called a NOT circuit, or inverter, in which the output is always the inverse of the input. Taking Figure 8-1 as an example, if a high voltage is applied to the input ($V_{in}=+V$), Q1 is turned on, and a low collector saturated voltage is developed at the output, and if a low voltage is applied to the input ($V_{in}=0$), Q1 turns off and high supply voltage is developed. The truth table is as shown.

Input	Output
0	1
1	0

Fig. 7-6. Truth table of NOT

The equation is as follows:

- AND $X = A \cdot B$ (8-2)
- OR $X = A + B$ (8-4)
- NOT $X = \bar{A}$

The basic logical function is these three. But instead of them, NOR circuits and NAND circuits may be the basic circuits, which are the combinations of NOT and AND, and NOT and OR.

NAND = AND + NOT = $\overline{A \cdot B}$
 NOR = OR + NOT = $\overline{A + B}$

Table 7-1. Logic symbol

NAME	SYMBOL	NAME	SYMBOL
logic product AND		negation NOT	
logic sum OR		logic negation	 <small>This symbol indicates that an inversion takes place. (This mark is using necessarily with other symbol)</small>
NAND		Exclusive OR	
NOR		Flip Flop	

Table 7-2. Logic symbols of all sorts

NAME	SYMBOL
logic product AND	
logic sum OR	
negation NOT	

7-2. Binary Number System

Numbers we usually use are 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9, which have each different meaning. This is decimal system, whose units are powers of ten. The meaning which each of the numbers from 0 to 9 have is called significance. By means of decimal system, 1234, for example, is expressed as follows:

$1234 = 1 \times 10^3 + 2 \times 10^2 + 3 \times 10^1 + 4 \times 10^0$

The base is 10. It is said that the base of 10 originates in 10 fingers of man's hands. But 10 is not only one base to express number. If the base is 2, 1234 is expressed as follows:

The maximum power of 2 smaller than 1234 is $2^{10} = 1024$. Then, $1234 = 2^{10} + X1$ $X1 = 210$

- In the same manners,
- $X1 = 2^7 (= 128) + X2$ $X2 = 82$
- $X2 = 2^6 (= 64) + X3$ $X3 = 18$
- $X3 = 2^4 (= 16) + X4$ $X4 = 2$
- $X4 = 2^1 (= 2)$

Then, $1234 = 2^{10} + 2^7 + 2^6 + 2^4 + 2^1 = 10011010010$

Such a number system whose base is 2 is called the Binary Number System, whose units are powers of 2. Numbers of the binary number system are 1 and 0 only. This is most convenient to digital circuit in which only two states are permitted, like high voltage and low voltage. But this binary number is not familiar to us, even though it is convenient to digital system. For example, it is difficult to know intuitively how to express the above 10011010010 by means of decimal system and 1234 by means of binary number system. Accordingly, it is necessary to convert decimal number into binary number when putting numbers into a computer, and conversely to convert binary numbers into decimal number when expressing the result. Then, instead of absolute binary numbers symbolized binary numbers are used for computer programming.

One of the symbolized binary numbers is Binary Coded Decimal (BCD). As in Table 8-3 (a), absolute binary numbers are counted by multiplying 2. But by means of the binary coded decimal system, the figure of each digit in the decimal system is expressed with binary number. Only numbers from 0 to 9 are expressed by absolute binary number.

Table 7-3. Decimal and binary number

Decimal	(a) Binary coded decimal	(b) Absolute binary number
0	0000	0000
1	0001	0001
2	0010	0010
3	0011	0011
4	0100	0100
5	0101	0101
6	0110	0110
7	0111	0111
8	1000	1000
9	1001	1001
10	1010	00010000
11	1011	00010001
12	1100	00010010
13	1101	00010011
14	1110	00010100
15	1111	00010101

Taking 1234 as an example, it is expressed as follows, by binary coded decimal:

$1234 = 0001 : 0010 : 0011 : 0100$

Each decimal digit is expressed by a binary number. Decimal numbers have ten significances from 0 to 9. Then, to distinguish each significance with the combination of 0 and 1 of a binary number, a binary number of 4 digits is necessary. This is because 3 digits distinguish only 8 states ($2^3 = 8$). On the other hand, 4 digits distinguish 16 states ($2^4 = 16$) and six states are unnecessary. This is seemed wasteful but is convenient, because conversion can be done intuitively. A digit in the decimal system, which can be 0,1,2,3,4,5,6,7,8 and 9 is called a "Bit" in the binary system, and can be 0 and 1. Accordingly, 1 digit is expressed with 4 bits by means of binary coded decimal. And when some bits mean one thing, this is called word, bite or code.

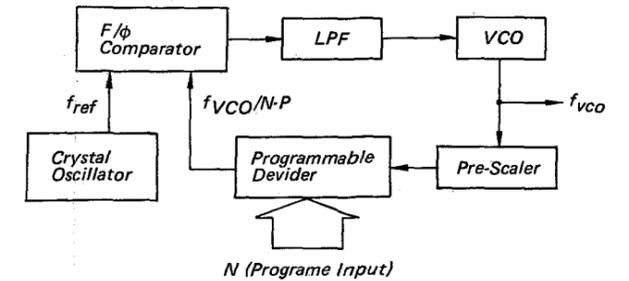


Fig. 7-7.

Fig. 7-7 is a block diagram of a typical PLL synthesizer.

An F/ϕ comparator compares $f_{VCO}/N \cdot P$ with f_{ref} and when they are in a phase or they have a certain phase difference, f_{VCO} is locked.

When f_{VCO} is locked, the following relation exists:

$f_{VCO}/N \cdot P = f_{ref}$

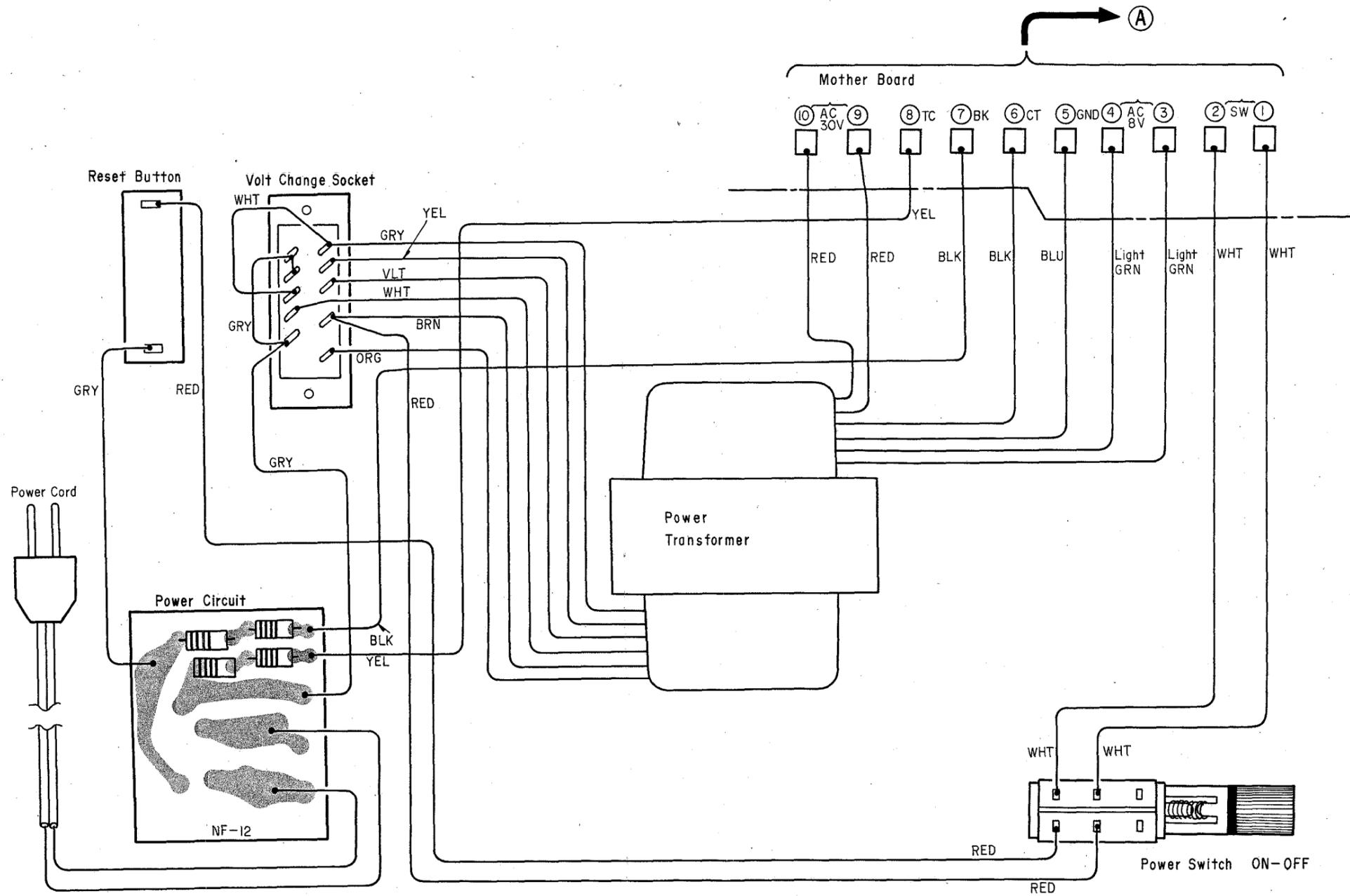
then, $f_{VCO} = N \cdot P \cdot f_{ref}$

This means that f_{VCO} can be any frequency which is a multiple of $P \cdot f_{ref}$ and can be varied with optional N.

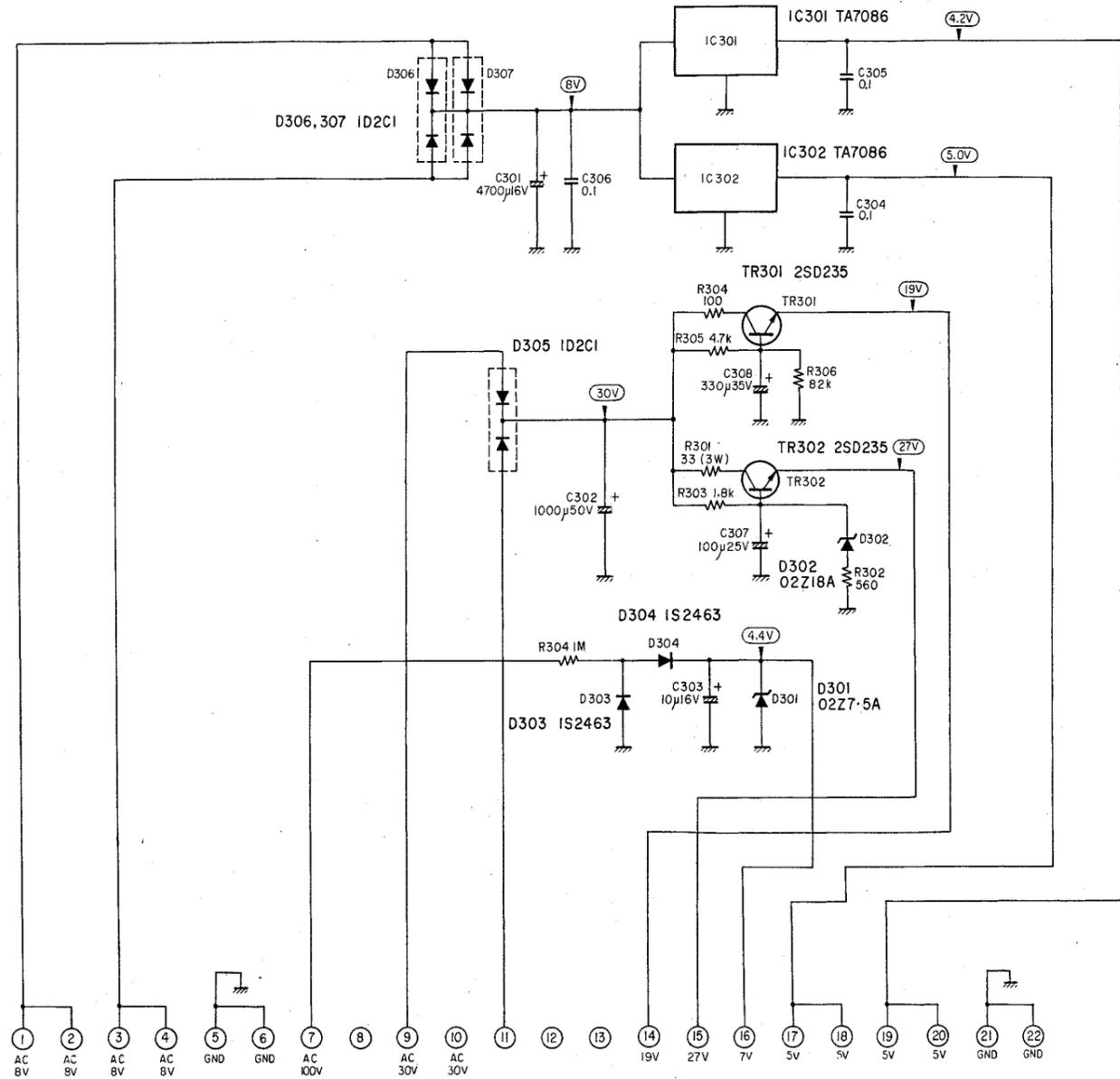
In ST-910: $f_{ref} = 25 \text{ kHz}$,
 $P = 4$,
 $N = 982 \sim 1186$.

8. SCHEMATIC AND MOUNTING DIAGRAM

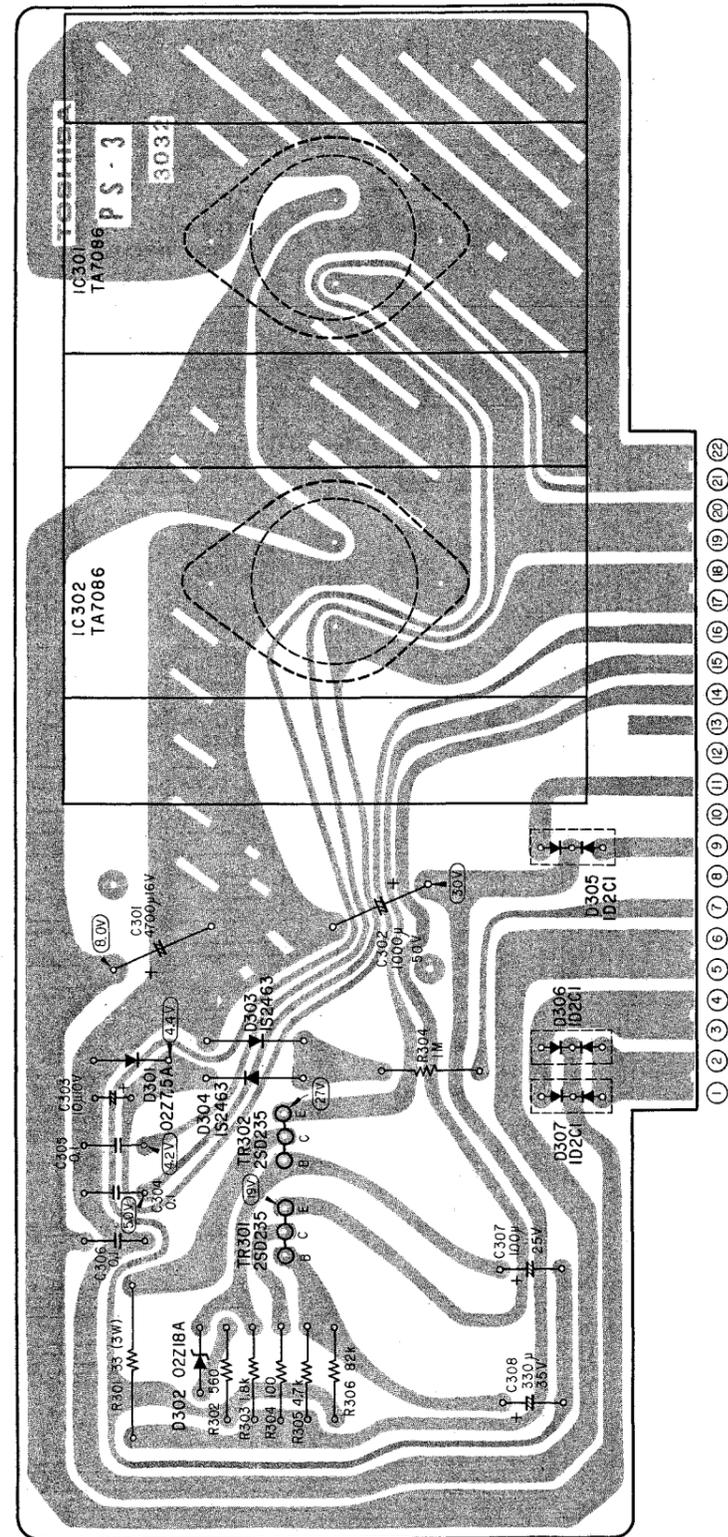
8-1. Schematic Diagram I, Wiring Diagram



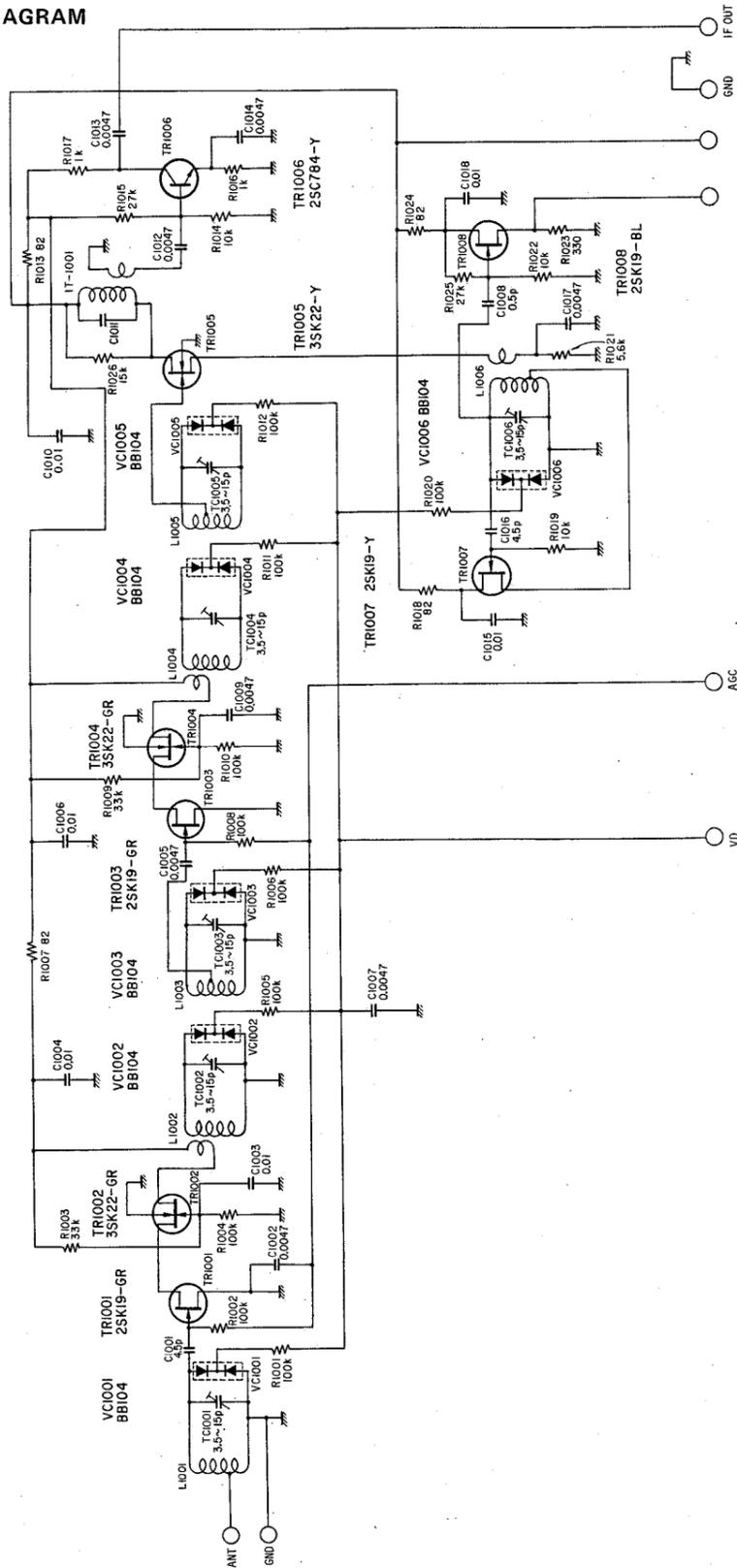
8-3. Power Supply Unit CCT-PS-3
SCHEMATIC DIAGRAM



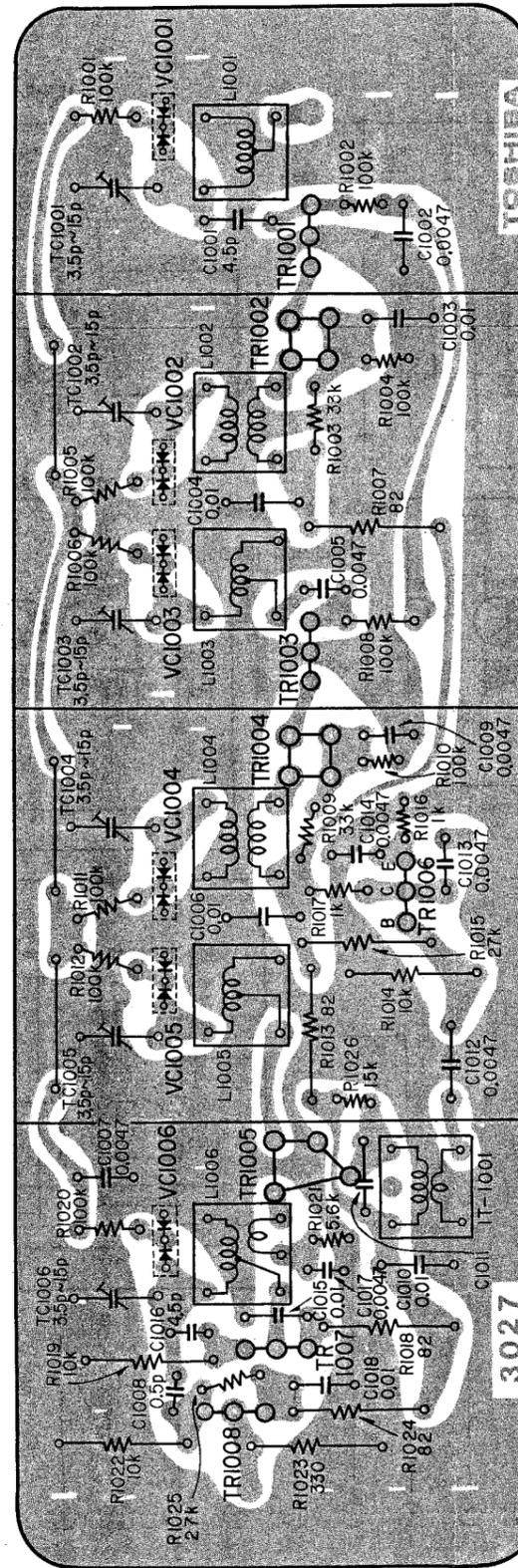
Power Supply Unit
BOTTOM VIEW



8-4. Front End Unit CCT-FE-10
SCHEMATIC DIAGRAM

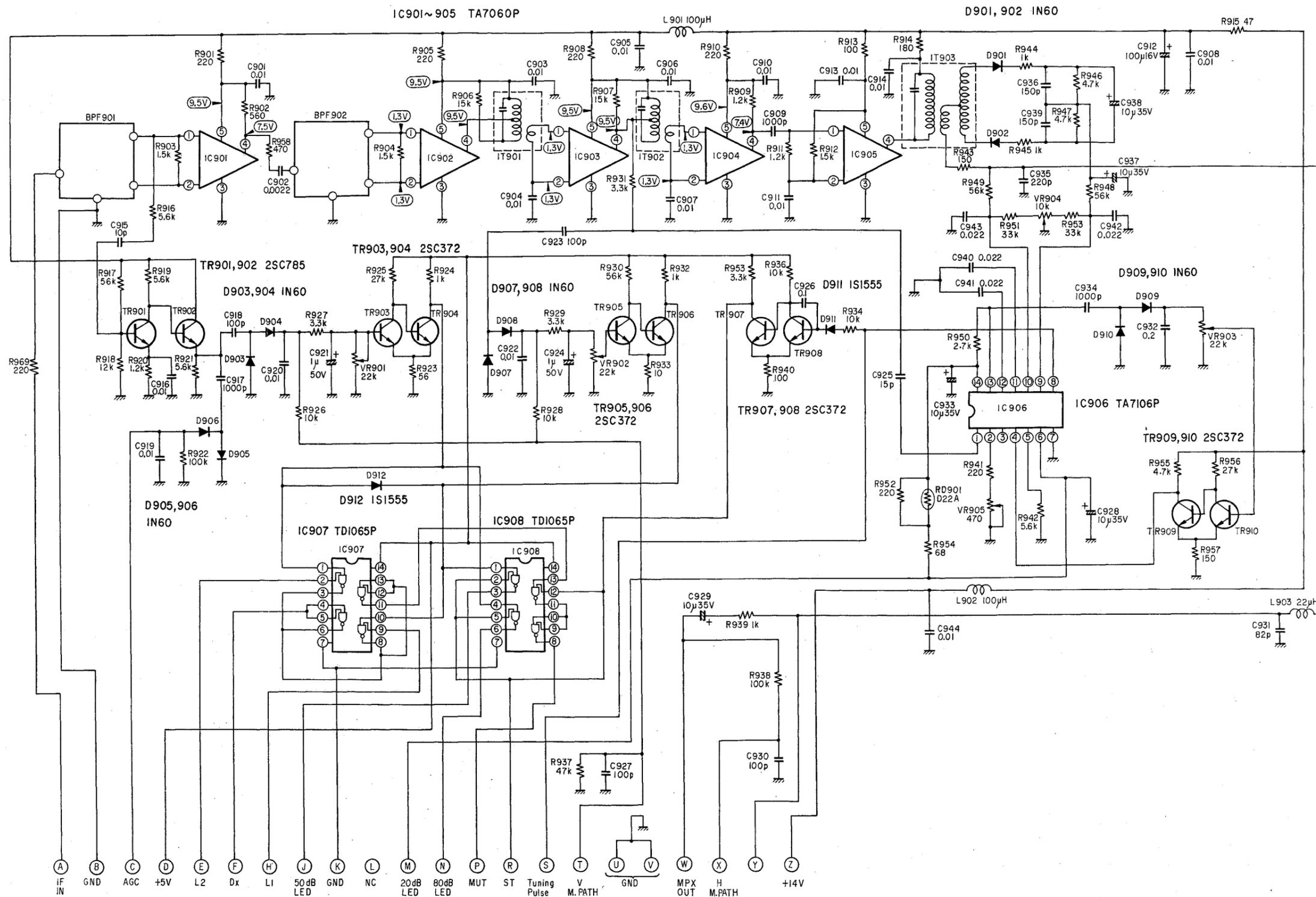


BOTTOM VIEW

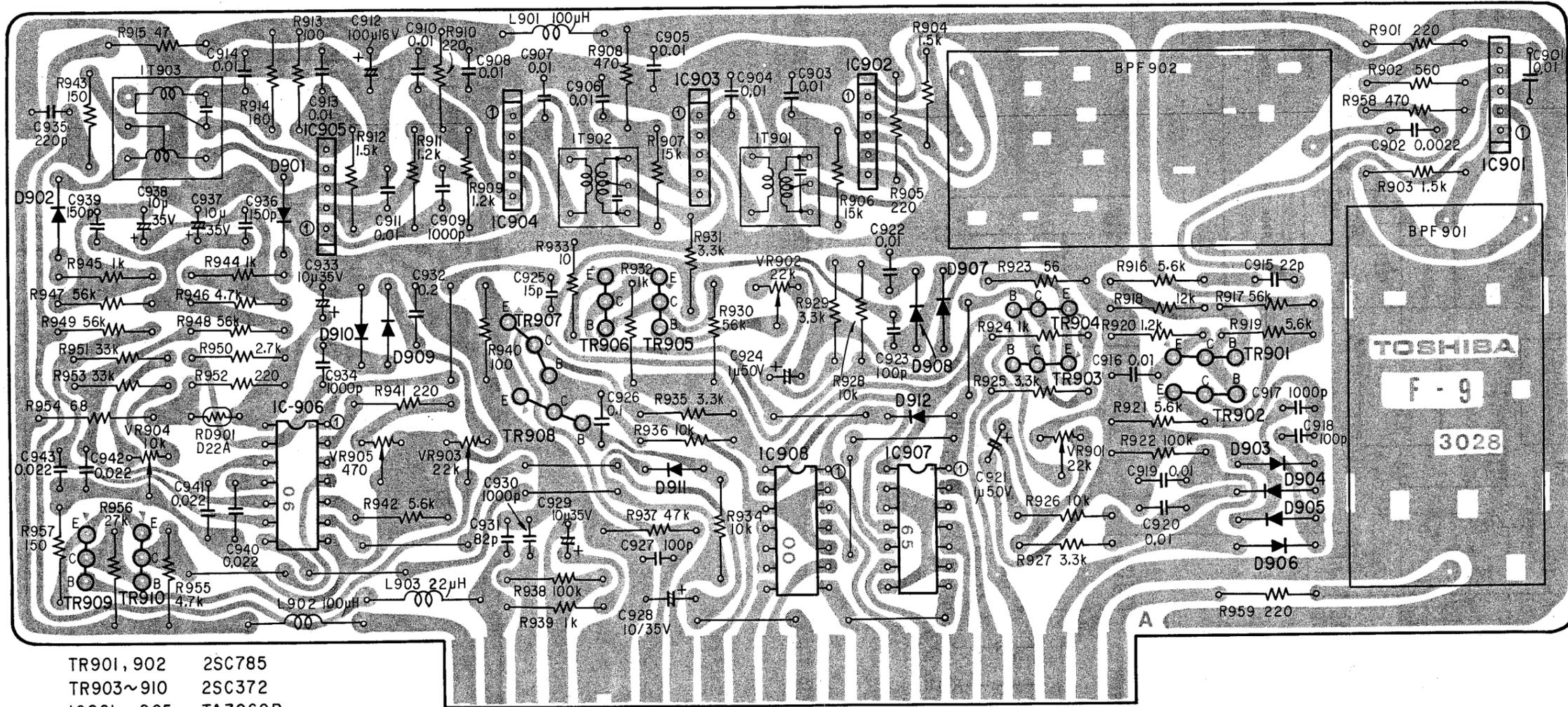


- TR1001, 1003 2SK19-GR
- TR1002, 1004 3SK22-GR
- TR1005 3SK22-Y
- TR1006 2SC784-Y
- TR1007 2SK19-Y
- TR1008 2SK19-BL
- VC1001~1006 BB104

8-5. IF Unit CCT-IF-9
SCHEMATIC DIAGRAM



BOTTOM VIEW



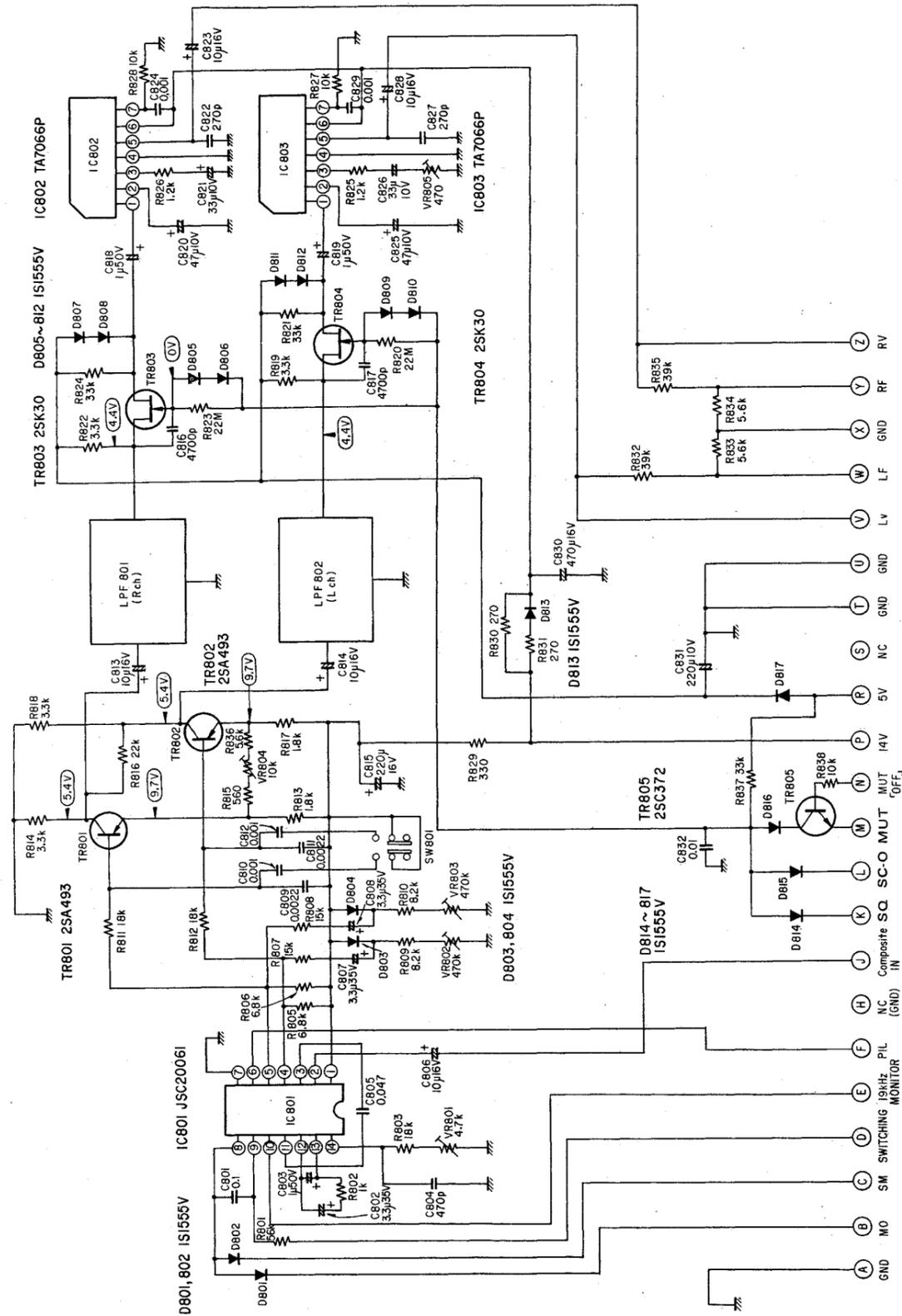
- TR901, 902 2SC785
- TR903~910 2SC372
- IC901~905 TA7060P
- IC906 TA7106P
- IC907, 908 TD1065P
- D901~910 IN60
- D911, 912 ISI555

(Z) (Y) (X) (W) (V) (U) (T) (S) (R) (P) (N) (M) (L) (K) (J) (H) (F) (E) (D) (C) (B) (A)

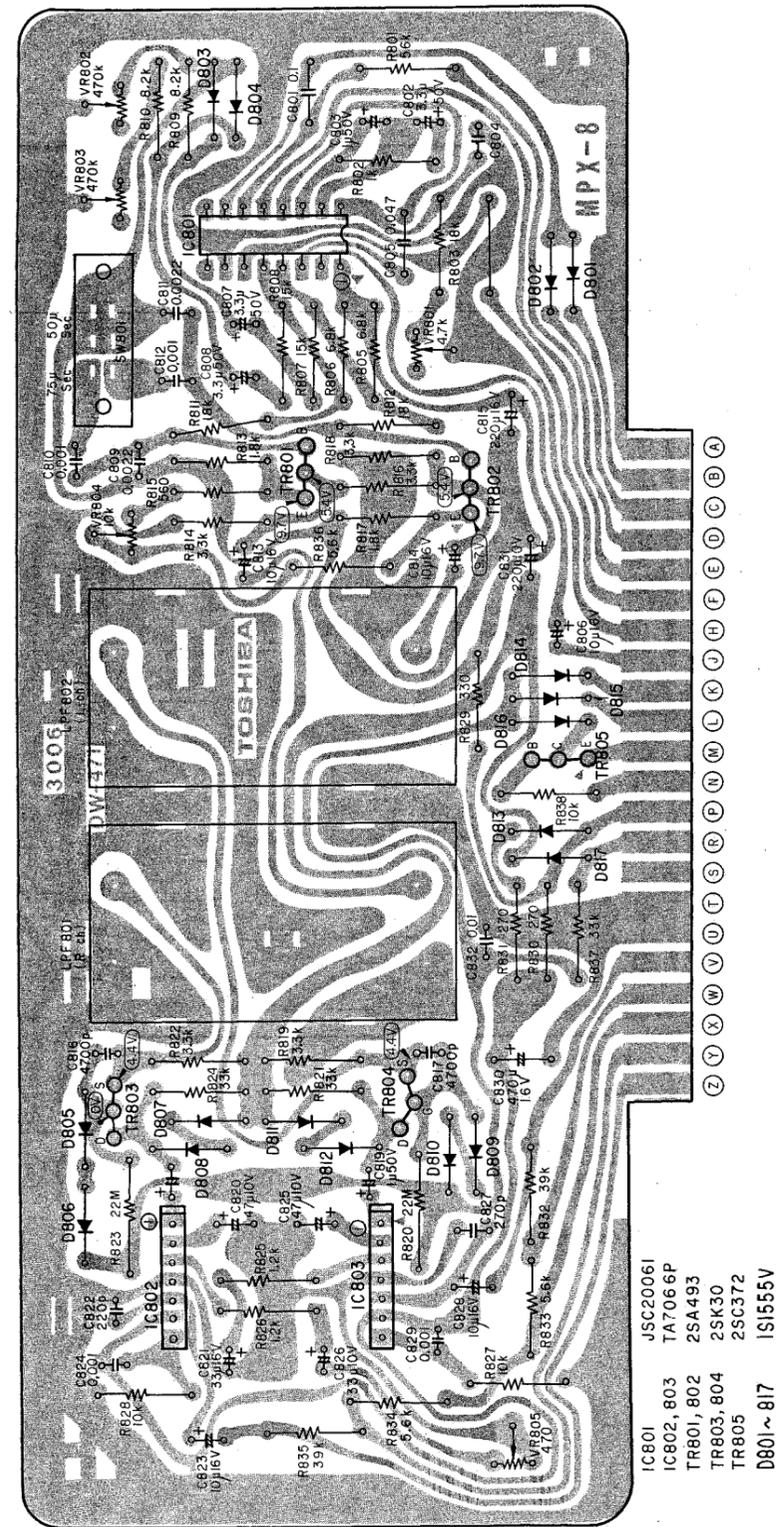
VOLTAGE CHART

	1	2	3	4	5
IC901			GND	7.5 V	9.5 V
IC902	1.3 V	1.3 V	GND	9.5 V	9.5 V
IC903	1.3 V	1.3 V	GND	9.5 V	9.5 V
IC904	1.3 V	1.3 V	GND	7.4 V	9.6 V

8-6. Multiplex Unit CCT-MPX-8
SCHEMATIC DIAGRAM



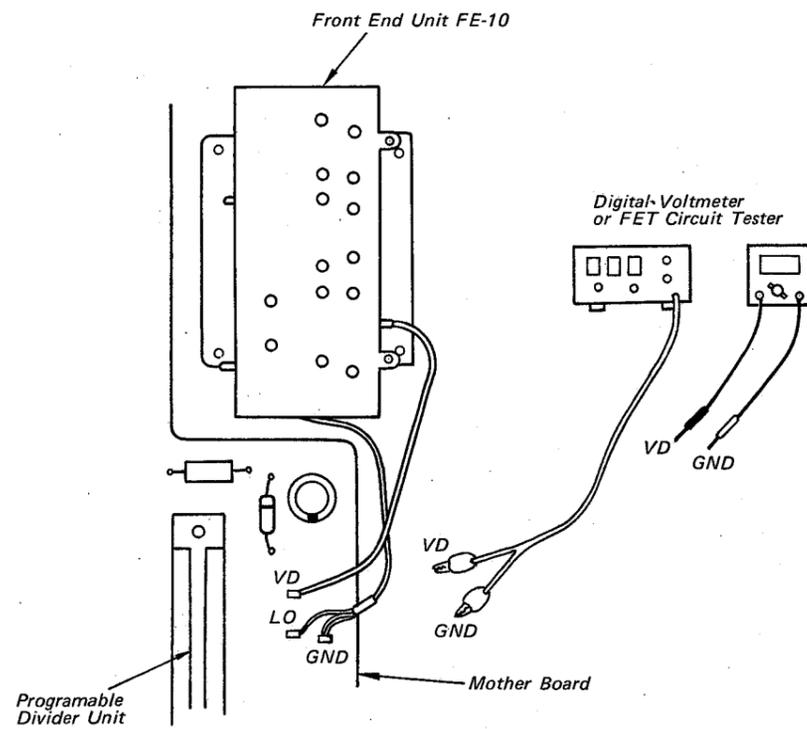
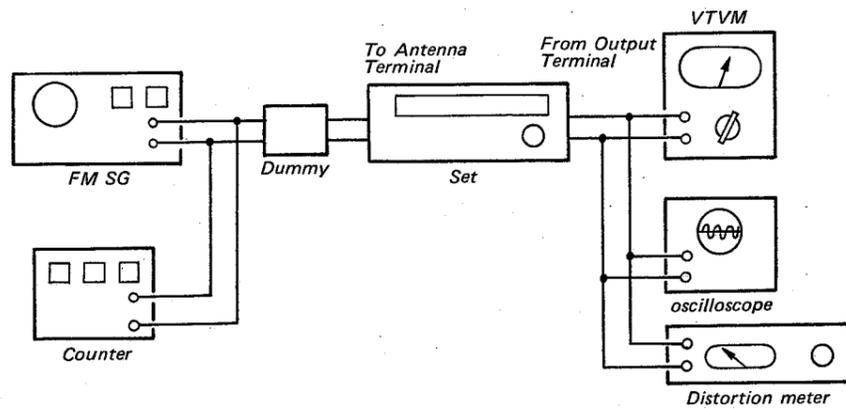
BOTTOM VIEW



- IC801 JSC20061
- IC802, 803 TA7066P
- TR801, 802 2SA493
- TR803, 804 2SK30
- TR805 2SC372
- D801~817 IS1555V

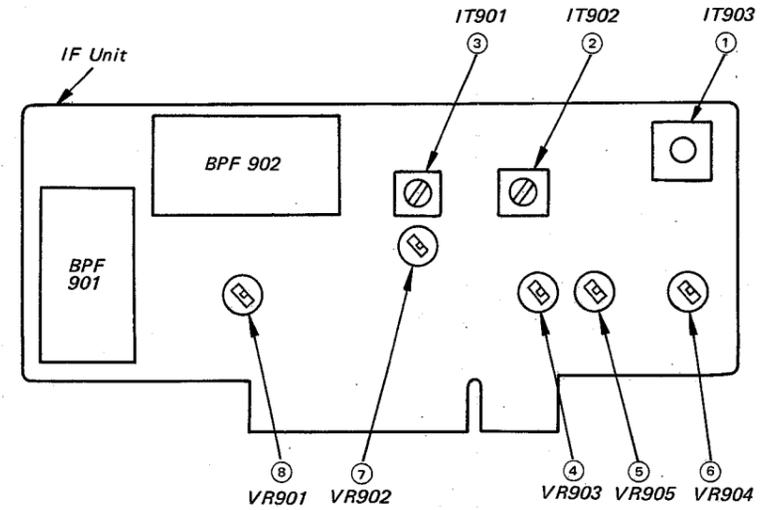
9. CIRCUIT ADJUSTMENTS

9-1. RF ADJUSTMENTS



1. Adjust Vd (Voltage across Varicap) to 4.0V at 87.5 MHz and to 25.0 V at 107.9 MHz with L1006 and TC1006. Repeat two or three times for precise adjustment.
2. Check the frequency calibration at 98.0 MHz.
 - Notes:
 - o FM signal generator shall be switched on 30 minutes before use.
 - o Calibrate the signal generator for 1 kHz accuracy at 98.000 MHz (106 dB, with no modulation) with a 250 MHz frequency counter.
 - o After the signal generator calibration, turn off the frequency counter to prevent interference.
3. Adjust oscillator coil and trimmer for maximum sensitivity at 88 MHz and 107.8 MHz, respectively. Repeat several times to minimize tracking error.

9-2. Distortion and Separation Adjustment



1. Feed frequency-counter-calibrated 98.000 MHz signal from a signal generator and tune the receiver to it.
2. Minimize MPX OUT distortion with discriminator transformer ①. (monaural)
 - Specification: 0.15 % maximum
 - Conditions: Carrier; 98.000 MHz, 60 dB
 - Modulation; 75 kHz deviation at 1 kHz

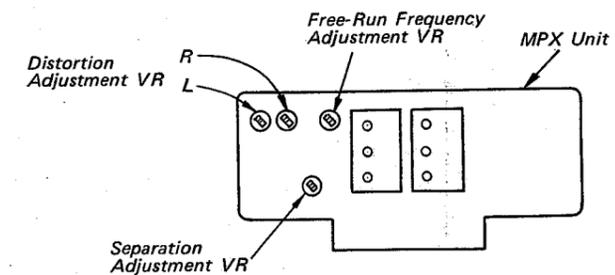
Notes:

- o Since this discriminator adjustment causes pulse position change, re-adjust VR ⑥ so that SIGNAL LEVEL indicator on the front panel lights.
- o Use external modulation.

3. Minimize L- and R-channel distortion with distortion adjustment VRs. (stereo)
 - Specification: 0.2 % maximum

Notes:

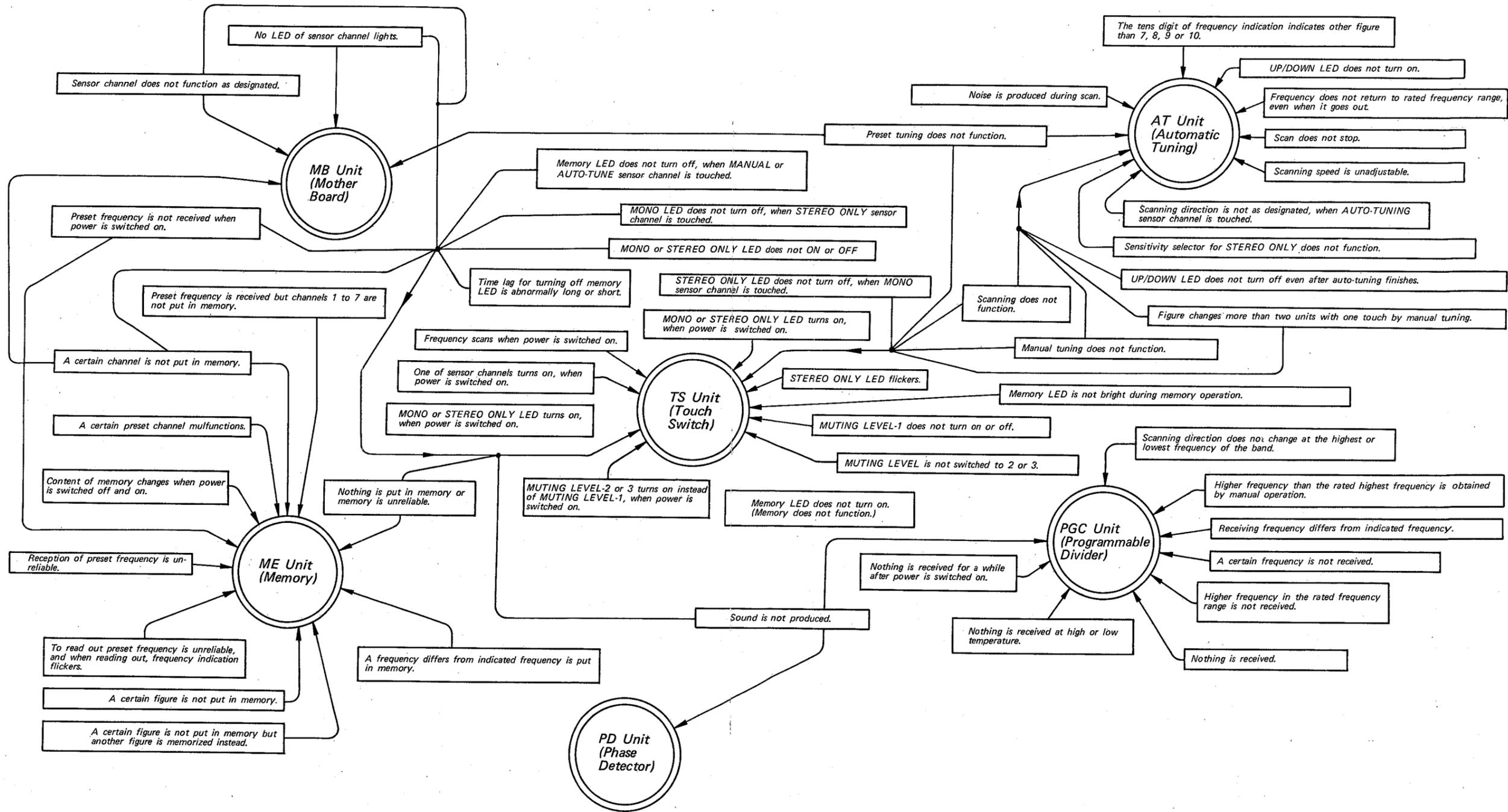
- o Use external stereo modulator.
- o Make sure that monaural distortion is less than 0.15 % when MONO SW is depressed.



4. Adjust separation adjustment VR for maximum separation by switching stereo modulator for L- or R-channel modulation.
5. Remove IF unit and check the pulse width.
6. Adjust LED lighting level with VRs ④, ⑦ and ⑧ on IF unit, as follows.

LED	adjust	lighting level
20 dB	VR ④	- 12 ~ - 20 dB
40 dB	VR ⑦	- 32 ~ - 43 dB
60 dB	VR ⑧	- 52 ~ - 63 dB

10. TROUBLE SHOOTING CHART
(Digital Circuit)



11. PARTS LIST

SYMBOL NO.	PART NO.	DESCRIPTION	SYMBOL NO.	PART NO.	DESCRIPTION
TRANSISTORS, DIODES & INTEGRATED CIRCUIT					
IC101,102 IC103,104 D101-123		(Mother Board Section) I.C., TC7420P I.C., TC7404P Diode, 1S1555V	IC610,612,613 IC614,618,619 IC615-617 TR601-603 D601-603		I.C., TD3404AP I.C., TD3475AP I.C., TD1065P Transistor, 2SA495 Diode, 1S1555V
IC201 IC202-204 IC203-205 IC206 TR201 TR202 D201, D213-217 D202-212, D218-220 LED201-204	22115248	(Front Panel Section) I.C., TD3442AP I.C., TD3447AP I.C., TD1072P I.C., TD3400AP Transistor, 2SA496 Transistor, 2SA495 Diode, Radiation, TLR102 Diode, Radiation, GL-30PG Diode, Radiation, TLR306	IC701,702, IC710,711 IC703-708 IC712-718 IC709 TR701-703 D701-726	22114015 22114014	(Programmable Divider Section) I.C., TD3502AP I.C., SN74SOON I.C., TD3474AP I.C., TD3400AP I.C., SN74S74N Transistor, 2SC732-GR Diode, 1S1555V
IC301,302 TR301,302 D301 D302 D303,304 D305-307		(Power Supply Section) I.C., TA7086 Transistor, 2SD235 Diode, 02Z7.5A Diode, 02Z18A Diode, 1S2463 Diode, 1D2C1	IC801 IC802,703 TR801,802 TR803,804 TR805 D801-817	22114376	(Multiplex Section) I.C., JSC20061 I.C., TA7066P Transistor, 2SA493 Transistor, 2SK30 Transistor, 2SC372 Diode, 1S1555V
IC401,402, 409,415,417 IC403,404, 410,416 IC405,406 IC407,412 IC408 IC411 IC413 IC414 IC418,419 D401-410 D411 TR401-403 TR404		(Touch Switch Section) I.C., TD3404P I.C., TD3400P I.C., TC7404P I.C., TD3473AP I.C., TD1062P I.C., TD3410P I.C., TC7400P I.C., TD3475AP I.C., TD3493P Diode, 1S1555V Diode, 1N60 Transistor, 2SC372 Transistor, 2SC372-0	IC901~905 IC906 IC907, 908 TR901,902 TR903-910 D901-910 D911 TR1001,1003 TR1002,1004 TR1005 TR1006 TR1007 TR1008 VC1001-1006	22111002	(I.F. Section) I.C., TA7106P I.C., TD1065P I.C., TA7060P Transistor, 2SC785 Transistor, 2SC372 Diode, 1N60 Diode, 1S1555V (Front End Section) Transistor, 2SK19-GR Transistor, 3SK22-GR Transistor, 3SK22-Y Transistor, 2SC784-Y Transistor, 2SK19-Y Transistor, 2SK19-BL Diode, BB104
IC501,508 IC502-505, IC510,511 IC506 IC507 IC509 IC512 IC513 TR501-505 D501-507 D508-511		(Auto Tuning Section) I.C., TD1065P I.C., TD3400AP I.C., TD3474AP I.C., TD34192AP I.C., TD1072P I.C., TD3419AP I.C., TD1060P Transistor, 2SC372 Diode, 1S1555V Diode, 1N60	IC1101,1103 IC1102 IC1104 IC1105 TR1101 TR1102,1103 D1101-1104	22114016	(Phase Detector) I.C., TD3400P I.C., TD3420P I.C., TD3410AP I.C., SN74S112 Transistor, 2SC372-Y Transistor, 2SC734 Diode, 1S1555V
COILS & TRANSFORMERS					
IC601-603 IC604 IC605,606 IC607,611 IC608 IC609		(Memory Section) I.C., TC7476P I.C., TC5000C I.C., TC7400P I.C., TD3442AP I.C., TD3410AP I.C., TD3502AP	L401,402 L501 L701	22241013 22241013 22211178	(Antenna Circuit Section) Coil, Antenna, LH-9050 (Touch Switch Section) Coil, Choke, LH10-10130 (Auto Tuning Section) Coil, Choke, LH10-10130 (Programmable Divider Section) Coil, Choke, LH-111780

SYMBOL NO.	PART NO.	DESCRIPTION	SYMBOL NO.	PART NO.	DESCRIPTION
(Front End Section)					
L1001 L1002 L1003 L1004 L1005 L1006 IT1001 T1	22294255 22294256 22294257 22294256 22294257 22294258 22265655 22213889	Coil, FM, RT-8134255 Coil, FM, RT-8134256 Coil, FM, RT-8134257 Coil, FM, RT-8134256 Coil, FM, RT-8134257 Coil, FM, RT-8134258 Transformer, IF, IT-6478 Transformer, power	C801 C802 C803 C804 C805 C806 C807,808 C809 C810 C811 C812	22340002 22448339 22448109 22382471 22373473 22445100 22448339 22382222 22382102 22382222 22382102	(Multiplex Section) Ceramic, 0.1 mfd, Z Electrolytic, 3.3 mfd, 50V Electrolytic, 1 mfd, 50V Polystyrene, 470PF, K Mylar, 0.047 mfd, M Electrolytic, 10 mfd, 16V Electrolytic, 3.3 mfd, 50V Polystyrene, 0.0022 mfd, K Polystyrene, 0.001 mfd, K Polystyrene, 0.0022 mfd, K Polystyrene, 0.001 mfd, K
ELECTRICAL PARTS					
E1 E2 E3 E4	22167441 22167442 22167446 22746149	(Mother Board Section) Jack, 22P Jack, 14P Jack, 18P Pin, Connector	C813,814 C815 C816,817 C818,819 C820 C821 C822	22445100 22445221 22373472 22440060 22443470 22443330 22382221	Electrolytic, 10 mfd, 16V Electrolytic, 220 mfd, 16V Mylar, 4700PF, M Electrolytic, 1 mfd, 50V Electrolytic, 47 mfd, 10V Electrolytic, 33 mfd, 10V Polystyrene, 220PF, K
E5 E6 E7	22114376 22137017 22145938	(Multiplex Section) Multiplex, JSC20061 Filter, Low Pass Switch, Slide	C823 C824 C825 C826	22445100 22382102 22443470 22443330	Electrolytic, 10 mfd, 16V Polystyrene, 0.001 mfd, K Electrolytic, 47 mfd, 10V Electrolytic, 33 mfd, 10V
E8	22137016	(IF Section) Filter, Band Pass	C827 C828	22382271 22445100	Polystyrene, 270PF, K Electrolytic, 10 mfd, 16V
E9	22146677	(Phase Comparator Section) Switch, power	C829 C830 C831 C832	22382102 22445471 22445221 22373103	Polystyrene, 0.001 mfd, K Electrolytic, 470 mfd, 16V Electrolytic, 220 mfd, 10V Mylar, 0.01 mfd, M
E10 E11 E12 E13 E14 E15 E16 E16 E20	22148622 22163343 22163361 22163442 22167443 22167453 22176221 22176286 22167145	(Panel Back Section) Circuit Breaker Jack, US Pin 4P Jack, US Pin 7P Jack, US Pin 2P Socket, 10P Connector, AC Power Cord, UL (TY) Power Cord, E2ES (TE) Volt Change Socket	C901 C902 C903,904, 905,906,907, 908 C909 C910,911 C912 C913,914	22342103 22341222 22342103	(IF Section) Ceramic, 0.01 mfd, Z Ceramic, 0.0022 mfd, P Ceramic, 0.01 mfd, Z
E17	22137015	(Noise Filter Section) Noise Filter, LH-117015	C915 C916 C917 C918	22361220 22342103 22343101 22343101	Ceramic, 22PF, J Ceramic, 0.01 mfd, Z Ceramic, 1000PF, M Ceramic, 100PF, M
E18 E19	22162327 22163447	(Antenna Circuit Section) Terminal Connector, FR	C919,920 C921 C922 C923	22342103 22448109 22342103 22343101	Ceramic, 0.01 mfd, Z Electrolytic, 1 mfd, 50V Ceramic, 0.01 mfd, Z Ceramic, 100PF, M
CAPACITORS					
J = ±5 %, K = ±10 %, M = ±20 %, P = -0 + 100 %, Z = -20 + 80 %					
C001,002	22340066	(Antenna Circuit Section) Ceramic, 470PF, M	C924 C925 C926 C927	22448109 22361150 22342104 22343101	Electrolytic, 1 mfd, 50V Ceramic, 15PF, J Ceramic, 0.1 mfd, Z Ceramic, 100PF, M
C103,104,105, 106,107,108, 109,101,102	22343102	(Mother Board Section) Ceramic, 0.01 mfd, M	C928,929 C930 C931 C932 C933 C934 C935	22447100 22343101 22362820 22341204 22447100 22343101 22382221	Electrolytic, 10 mfd, 35V Ceramic, 1000PF, M Ceramic, 82PF, K Ceramic, 0.2 mfd, P Electrolytic, 10 mfd, 35V Ceramic, 1000PF, M Polystyrene, 220PF, K
C301 C302 C303 C304,305,306 C307 C308	22403046 22403039 22445100 22373104 22446101 22447331	(Power Supply Section) Electrolytic, 8000 mfd, 16V Electrolytic, 1000 mfd, 50V Electrolytic, 10 mfd, 16V Mylar, 0.1 mfd, M Electrolytic, 100 mfd, 25V Electrolytic, 330 mfd, 35V	C937,938 C939 C940,941, 942,943 C944	22447100 22382151 22342103 22342103	Electrolytic, 10 mfd, 35V Ceramic, 150PF, K Ceramic, 0.01 mfd, Z Ceramic, 0.01 mfd, Z

12. CABINET EXPLODED VIEW

