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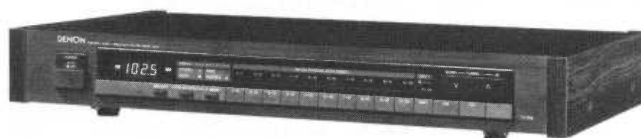
Hi-Fi AM-FM Stereo Tuner

SERVICE MANUAL

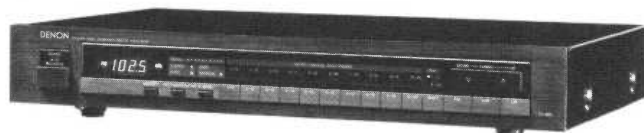
MODEL TU-600

AM-FM STEREO TUNER

EUROPEAN & U.S.A.



Wood Board Version



Standard Version

TABLE OF CONTENTS

SPECIFICATIONS	2
FUNCTIONS OF PANEL CONTROLS	3
BLOCK DIAGRAM	3
CONNECTIONS	4~5
REMOVAL OF EACH SECTION	6~7
DYNAMIC TWIN DRIVE DEMODULATOR	7
METHOD OF ADJUSTMENTS	8~9
SEMICONDUCTORS	10~13
PRINTED WIRING BOARD PATTERNS AND PARTS LIST	
ETC0827 TUNER UNIT	14~15
WIRING DIAGRAM	16
SCHEMATIC DIAGRAM	17
EXPLODED VIEW OF CHASSIS AND CABINET & PARTS LIST	18

NIPPON COLUMBIA CO., LTD.

SPECIFICATIONS

FM SECTION

Frequency Range: 87.5 ~ 108 MHz (for outside U.S.A.)

87.9 ~ 107.9 MHz (for U.S.A.)

Antenna Terminals: 75 ohm unbalanced/
300 ohm balanced

Practical Sensitivity: 0.9 μ V (10.2 dBf)

S/N 50 dB Sensitivity: Stereo: 20 μ V (37.2 dBf)
Monaural: 1.5 μ V (15.3 dBf)
The μ V is at 75 ohm and 0 dBf
at 10^{-15} W (new IHF Standard)

Image Interference Ratio: 80 dB

IF Interference Ratio: 100 dB

AM Suppression Ratio: 65 dB

Effective Selectivity: Wide = 50 dB (\pm 400 kHz)

Narrow = 70 dB (\pm 300 kHz)

Capture Ratio: 1.5 dB

Frequency Characteristics: 50 Hz to 15 kHz $\begin{matrix} +0.2 \\ -1.5 \end{matrix}$ dB

Signal-to-noise Ratio: Monaural: 92 dB
Stereo: 86 dB (IHF-A)

Total Harmonic Distortion: Monaural
(at 75 kHz deviation)

1 kHz 0.03%

Stereo

(at 67.5 kHz deviation)

1 kHz 0.04%

1 kHz 55 dB

Stereo Separation: 1 kHz

Muting Operating Level: 10 μ V

Output Level (at 75 kHz deviation): 0.6V

AM SECTION

Frequency Range: 522 ~ 1611 kHz (for outside U.S.A.)

530 ~ 1620 kHz (for U.S.A.)

Antenna Terminal: Terminal Type With Loop Antenna

Usable Sensitivity: 18 μ V

Selectivity: 35 dB 9 kHz (for outside U.S.A.),
10 kHz (for U.S.A.)

Signal-to-noise Ratio: 53 dB

Total Harmonic Distortion: 0.6%

Output Level (at 30% modulation): 0.18 V

Electric Field Strength Indication: 10 Segment LED's

OTHERS

Power Supply: AC 220 V/50 Hz (for Europe)
AC 120 V/60 Hz (for U.S.A. and Canada)

AC 240 V/50 Hz (for U.K. and Australia)

AC 110/120/220/240 V, 50/60 Hz (Multiple) (for Asia)

Power Requirement: AC 12 W

Dimensions: 464mm (18-17/64")W x 70mm (2-3/4")H x

281mm (11-1/16")D (with Wood Board)

434mm (17-3/32")W x 70mm (2-3/4")H x

281mm (11-1/16")D (without Wood Board)

3.7 kg (8 lbs. 3 oz) (with Wood Board)

3.2 kg (7 lbs. 1 oz) (without Wood Board)

Design and specifications subject to change without notice.

NOTE: The following codes correspond to the appropriate models.

EU for U.S.A., EA for Australia, EC for Canada, E1 for Asia and E2 for Europe.

This Service Manual is prepared based on E2 Black version.

For United Kingdom model only.

WARNING:

As the colours of the wires in the mains lead of this appliance may not correspond with the coloured markings identifying the terminals in your plug proceed as follows:

The wire which is coloured blue must be connected to the terminal which is marked with the letter N or coloured black.
The wire which is coloured brown must be connected to the terminal which is marked with the letter L or coloured red.

The wire which is coloured BROWN must be connected to the terminal which is marked with the letter L or coloured RED.

IMPORTANT

The wires in this mains lead are coloured in accordance with the following code:

Blue: Neutral
Brown: Live

For Australian model only.

FOR YOUR SAFETY

To ensure safe operation the three-pin plug supplied must be inserted only into a standard three-pin power point which is effectively earthed through the normal household wiring.

Extension cords used with the equipment must be three-core and be correctly wired to provide connection to earth. Wrongly wired extension cords are a major cause of fatalities.

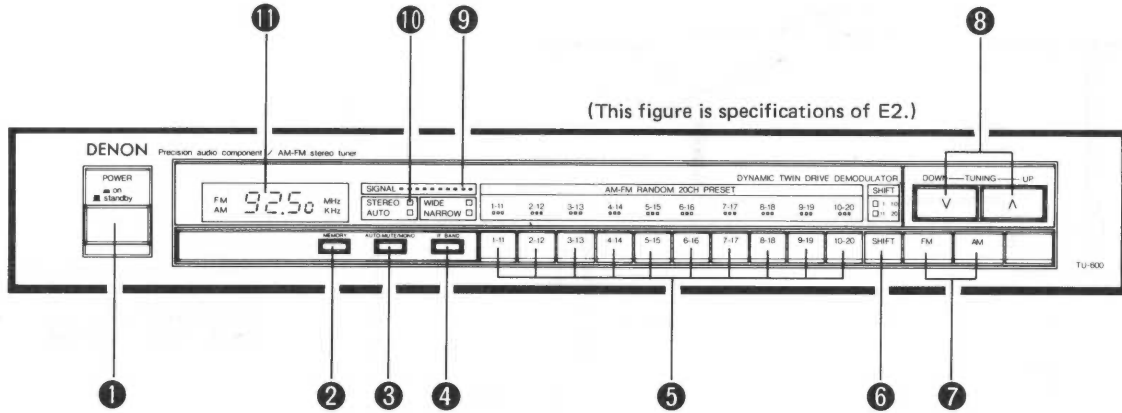
The fact that the equipment operates satisfactorily does not imply that the power point is earthed and that the installation is completely safe. For your safety, if in any doubt about the effective earthing of the power point, consult a qualified electrician.

For U.S.A. and Canada models

CAUTION

TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

FUNCTIONS OF PANEL CONTROLS



- | | |
|---|---|
| <ul style="list-style-type: none"> ① POWER (Power on/standby Switch or on/off Switch) ② MEMORY (Memory Button) ③ MODE (Mode Button)
AUTO/MUTE, MONO ④ IF BAND (IF Band Selector Button) ⑤ PRESET CHANNEL (Preset Channel Buttons)
1-10 ~ 11-20 ⑥ SHIFT (Shift Button) | <ul style="list-style-type: none"> ⑦ SELECT (Select Buttons)
FM, AM ⑧ TUNING (Tuning Buttons)
△ UP, ▽ DOWN ⑨ SIGNAL (Signal-Strength Indicators) ⑩ STEREO (Stereo Indicator) ⑪ DIGITAL FREQUENCY INDICATOR |
|---|---|

Fig. 1

BLOCK DIAGRAM

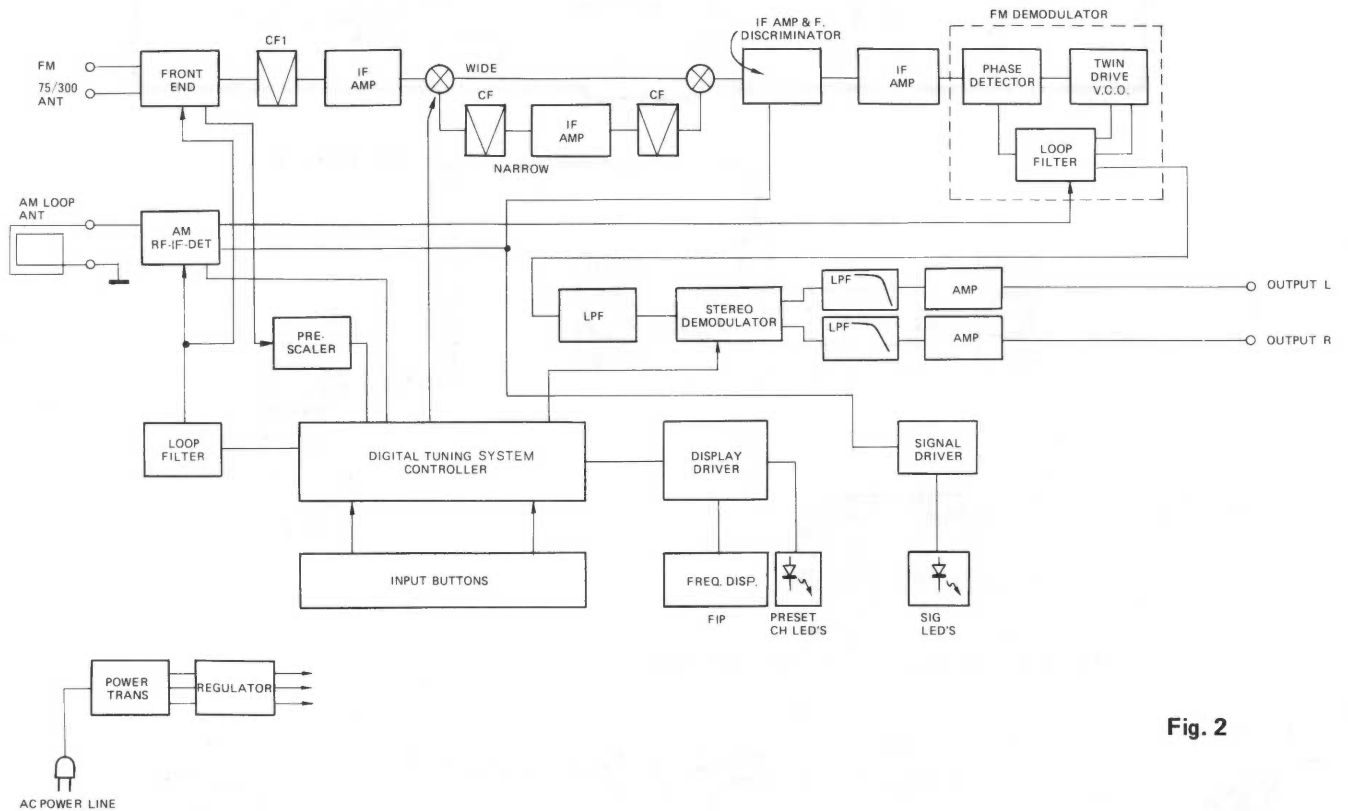


Fig. 2

CONNECTIONS

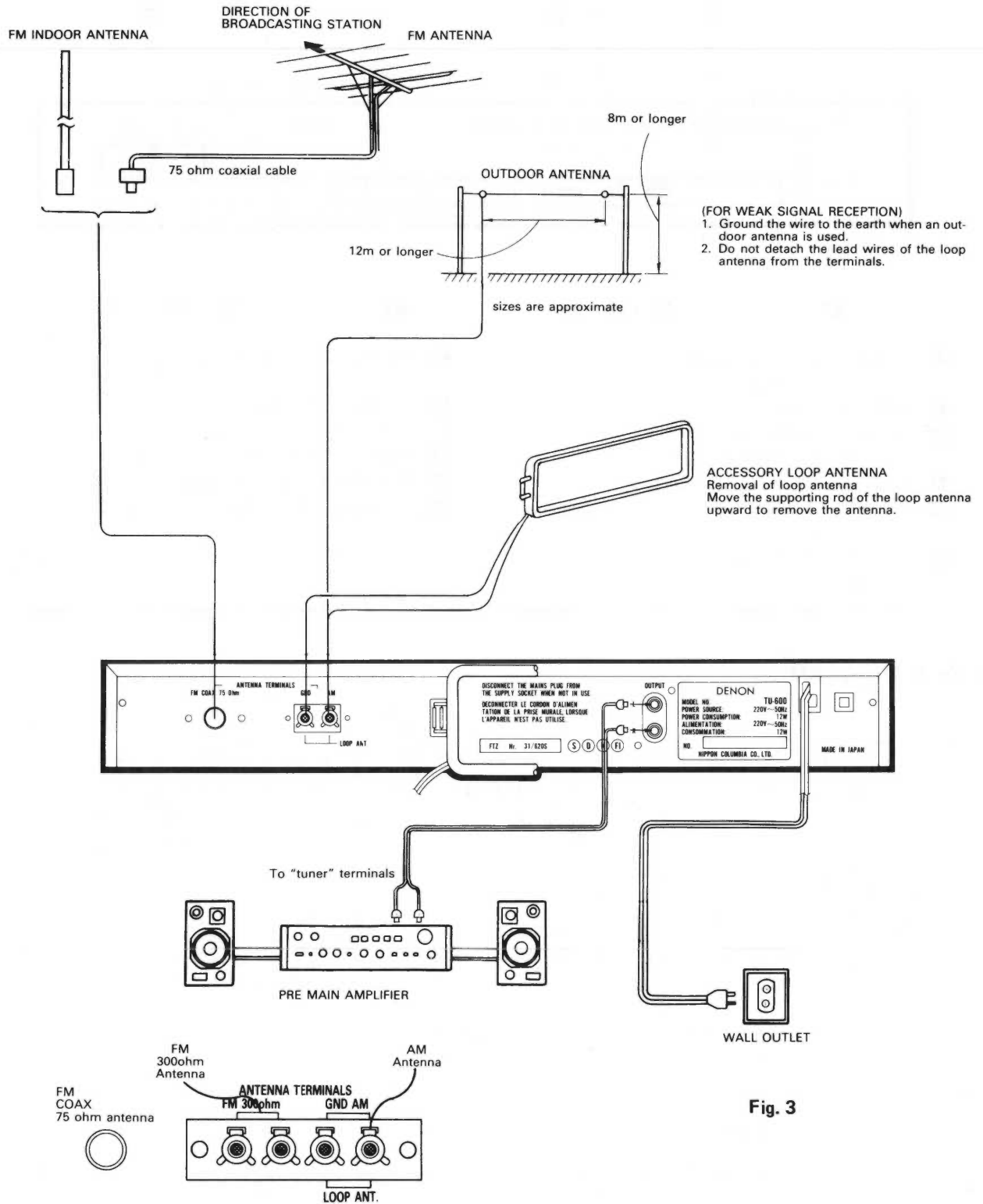


Fig. 3

For U.S.A., Canada, Australian and Asian models

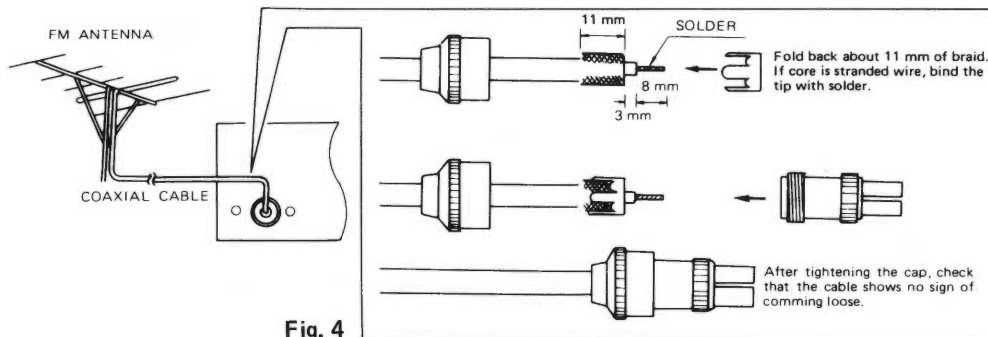


Fig. 4

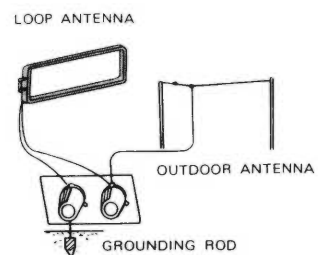


Fig. 5

ANTENNA INSTALLATION

- **LEAD WIRE FM INDOOR ANTENNA (Fig. 3)**

A lead wire indoor antenna can be used in a wood-frame house where broadcasting stations are located nearby and strong signals can be received. While receiving an FM program, extend the antenna. Orient for optimal reception and mount the antenna on the wall or ceiling.

* In general, FM indoor antenna might not consistently assure stable reception, due to environmental changes. In such case use an FM indoor antenna temporarily until an outdoor antenna is installed.

- **FM OUTDOOR ANTENNA CONNECTION (Fig. 4)**

Use 75-ohm coaxial cable or 300 ohm ribbon feeder, to connect the outdoor antenna and the tuner. The 75-ohm coaxial cable (3C-2V, 5C-2V) is preferable to obtain better performance of the tuner.

* Contact your local dealer for details on selection and installation of the FM outdoor antenna.

When connecting the coaxial cable to the antenna terminal using the DIN connector, please refer to the procedures in Fig. 3.

- **AM ANTENNA CONNECTION (Fig. 5)**

Since this model is provided with a high-performance loop antenna at the back panel, this accessory antenna can effectively be used for optimal reception in places where broadcasting stations are located nearby and relatively strong signals are received with low noise.

Orient the loop antenna horizontally for obtaining optimal reception.

In places where strong, clear signals are not received due to the particular location and/or environmental conditions, connect a vinyl lead wire to the AM antenna terminals and hold it to the wall or lintel.

In places where broadcasting stations are too far away and only weak signals are received, or where signals are blocked by obstacles, install an outdoor antenna for AM.

* Even if an outdoor antenna is installed, do not detach the loop antenna.

GROUNDING

If there is much noise during reception of a radio program, it is recommended that a grounding wire be used to ground the unit.

Connect a thick vinyl lead wire to the "GND" terminal, and wind the unconnected bare end around a metal water pipe, a grounding rod, or a grounded copper plate.

* Do not connect a grounding wire to a gas pipe in order to prevent explosion of fire.

PRECAUTIONS ON CONNECTIONS

Do not plug the cord into an AC outlet until all connections of the unit are completed.

- **CONNECTION WITH AUDIO AMPLIFIER**

Connect the pin cord (supplied) between the OUTPUT terminals of the tuner and the "tuner" input terminals of the audio amplifier. Be careful to connect the left (L) and right (R) channels of the output terminals to the corresponding left (L) and right (R) channels of the "tuner" input terminals. (Set the volume control of the audio amplifier to minimum).

- Do not bundle or wind the pin cord and the power source cord together, and do not place the pin cord near the power transformer; otherwise, hum noise may result.

- Insert the plugs into the corresponding jacks firmly because incomplete connections cause electric field noise.

USA MODEL ONLY

Note to CATV system installer:

This reminder is provided to call the CATV system installer's attention to Article 820-22 of the NEC that provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as practical.

Note: Microcomputer in IC402 might be written wrong data in its RAM, during the replacement of LITHIUM Battery for memory backup. If wrong data is memorized, (e.g. the function IF BANDWIDTH: NARROW after Auto stop) and cannot be controlled by the keys on the front panel, please make a short circuit for about 10 seconds between jumper wires J30 and J15 located near JC402, after plug off the mains.

REMOVAL OF EACH SECTION

1. How to remove the top cover (Fig. 6)

- (1) Remove the four screws (A) on both sides.
- (2) Remove one black screw (B) on the back panel.
- (3) Raise the back of the top cover and remove it.

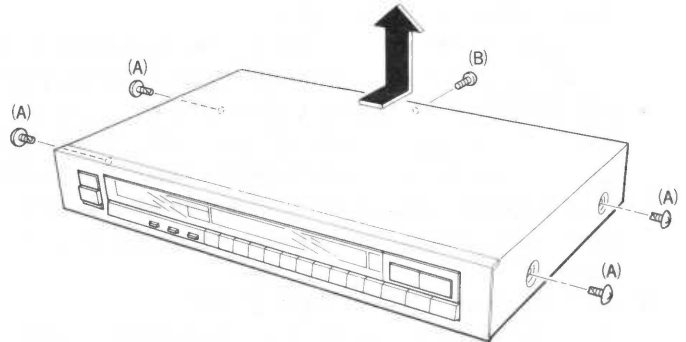


Fig. 6

2. How to remove the front panel ass'y (Fig. 7)

- (1) Remove the three screws (A) on the down side.
- (2) Remove the two screws (B) from both sides to release the chassis.
- (3) Remove the three screws (C) and fixing bracket from the PWB.
- (4) Pull out the three connector from the switch PWB and LED PWB.
- (5) Raise the front panel ass'y and remove it.

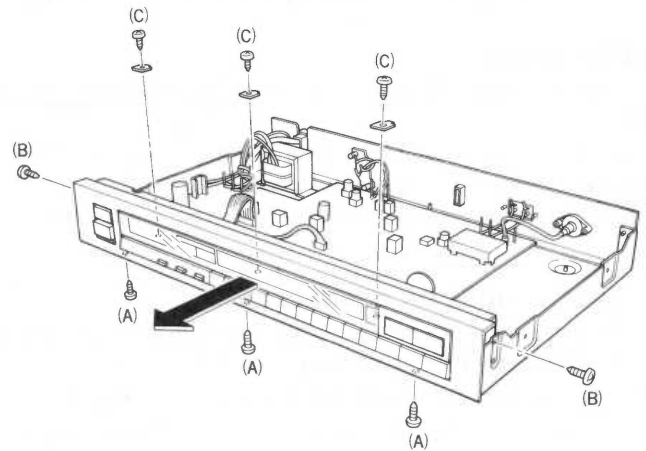


Fig. 7

3. Removing the TUNER UNIT (Fig. 8)

- (1) Pull out the connector for the FM antenna load.
- (2) Remove the 4 PWB holders that clamp the PWB, and remove the tuner unit.

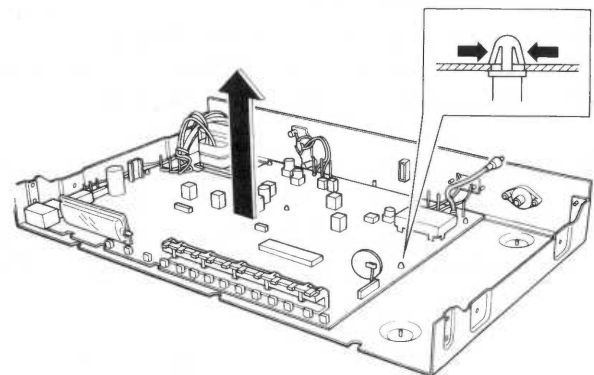


Fig. 8

4. Removing the switch PWB and the LED PWB (Fig. 9)

- (1) The switch PWB is removed by releasing the six clamps.
- (2) The LED PWB is removed by releasing the three clamps.

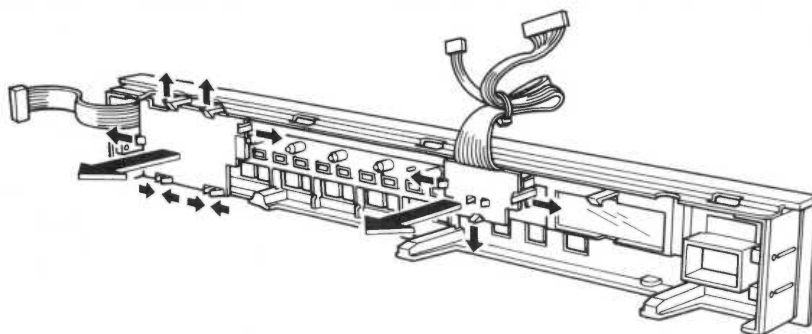


Fig. 9

DYNAMIC TWIN DRIVE DEMODULATOR

Dynamic Twin drive Demodulator is a kind of PLL (phase locked loop) FM demodulator, and consists of phase detector, loop filter and Twin Drive V.C.O. (voltage controlled oscillator). Twin Drive V.C.O. is provided with two pairs of varactor diodes, one is "master" and the other "corrector", which is connected reversely to the master. Both pairs of varactor diodes cooperate to track the oscillator frequency to the input frequency and then frequency modulated signal is demodulated. Considering about full one cycle of V.C.O., when the instantaneous voltage (that equals to the sum of control voltage and oscillating voltage) across the master varactor diodes increases, the instantaneous voltage across the corrector varactor diodes decreases, and vis-a-vis. Then harmonics of oscillating frequency is improved, and that results less harmonic distortion of demodulated audio signal.

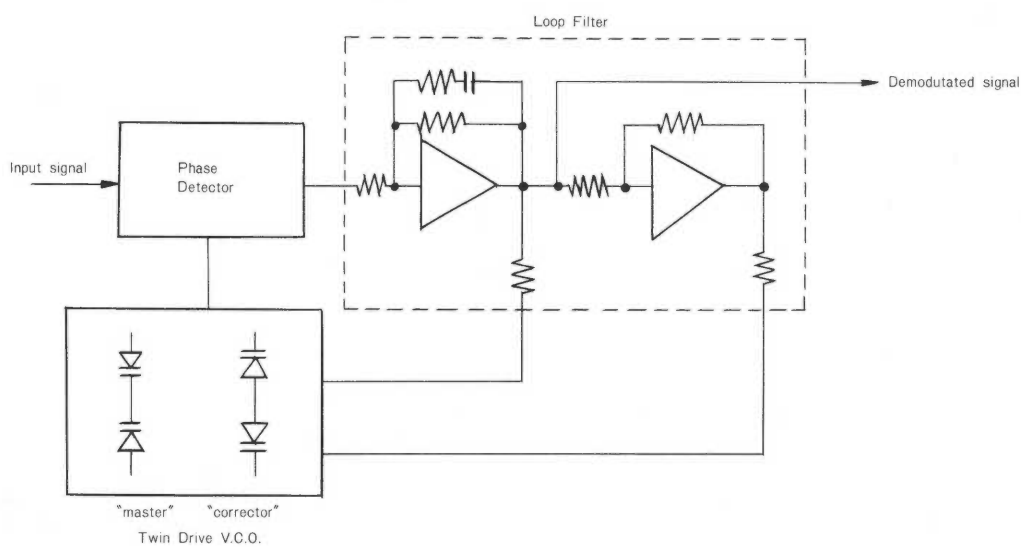


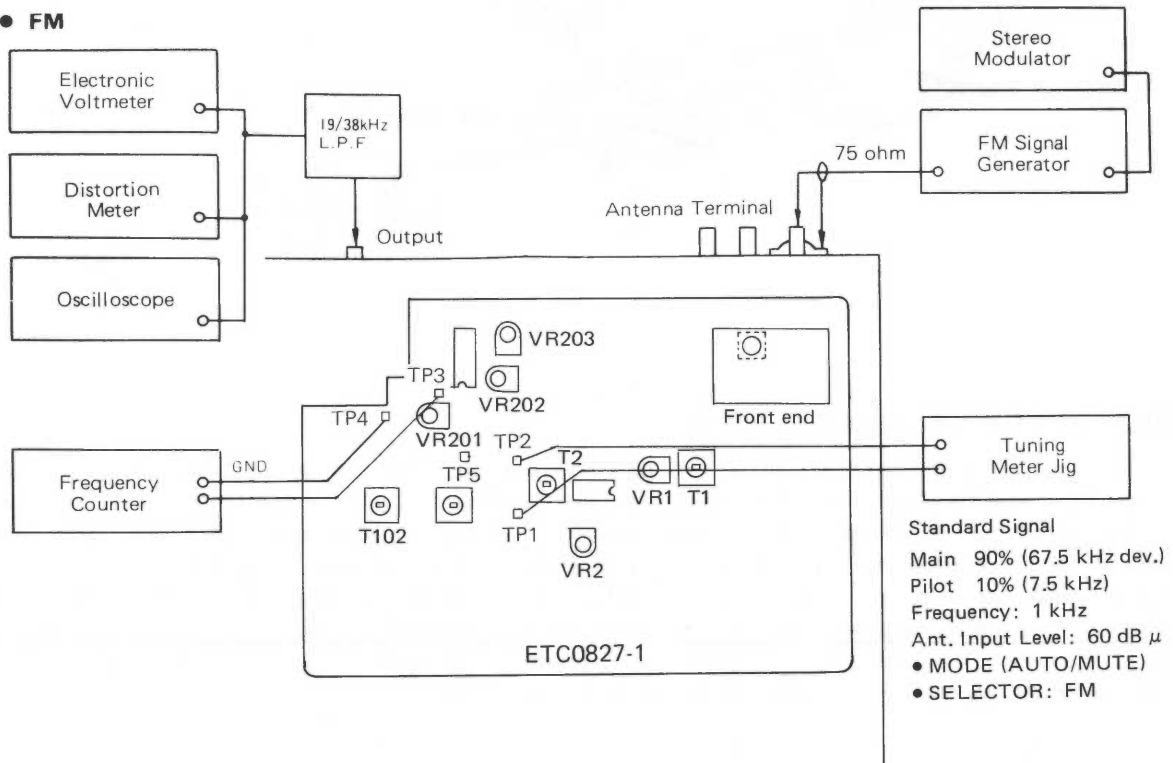
Fig. 10

METHOD OF ADJUSTMENTS

CONNECTION DIAGRAM OF MEASURING INSTRUMENTS

When making adjustments, be sure the power supply is at the rated voltage and the room air is on normal conditions with respect to temperature and humidity.

● **FM**



● **AM**

Modulation: 30%
 Mod. Frequency: 400 Hz
 Ant. Input: about 80 dB μ
 ● SELECTOR: AM

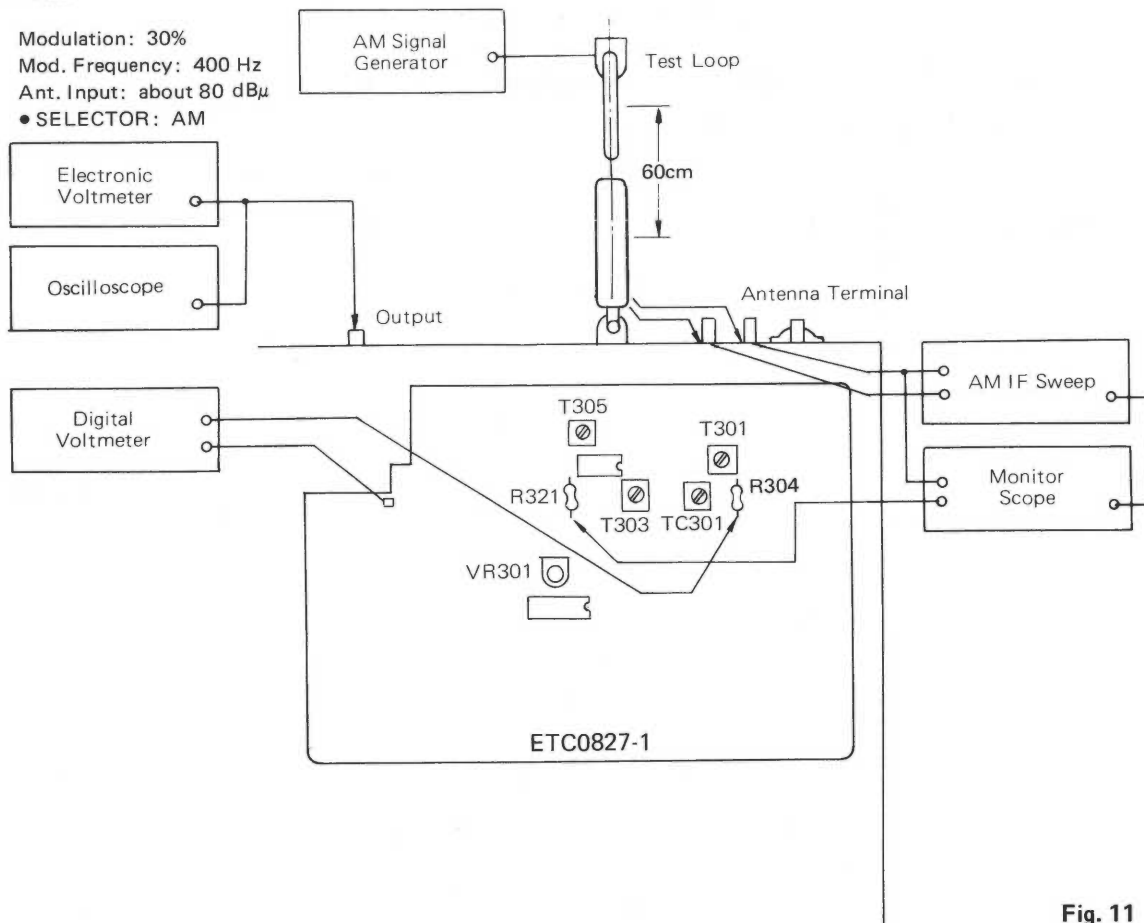


Fig. 11

FM

Table 1

Adjustment Item	Tuning	Input Side					Output Side		Adjustment Point	Adjustment Value	Remarks
		Measuring Instrument	Frequency	Input Level	Modulation	Connection Point	Measuring Instrument	Connection Point			
1 76 kHz	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	60 dBμ	Mono 1 kHz, 100%	Antenna Terminal	Frequency Counter	TP-3, 4	VR 201	76 kHz ± 50 Hz	
2 Center Adjustment	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	60 dBμ	Mono 1 kHz, 100%	Antenna Terminal	Tuning Meter Jig	TP-1, 2	T2	Tuning Meter Center	IF Band width "wide"
3 Center Adjustment	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	60 dBμ	Mono 1 kHz, 100%	Antenna Terminal	Tuning Meter Jig	TP-5, 4	T102	Tuning Meter Center	IF Band width "wide"
4 Stereo Distortion	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	60 dBμ	Stereo (L) 1 kHz Main 90% Pilot 10%	Antenna Terminal	Distortion Meter	Output (L)	Front End IFT	Min. Distortion	IF Band width "wide"
5 Signal Indicator LED ON Level	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	50 dBμ	Mono 1 kHz, 100%	Antenna Terminal	-	-	VR2	ALL LED ON	
6 Pilot Cancell	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	60 dBμ	Stereo (L) Pilot 10%	Antenna Terminal	Electronic Voltmeter	Output (L)	VR 202	Min. Pilot Leakage	19/38 kHz L.P.F. is not used
7 Separation	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	60 dBμ	Stereo (L) 1 kHz Main 90% Pilot 10%	Antenna Terminal	Electronic Voltmeter	Output (L) Output (R)	VR 203	Max. Separation balance of directivity)	19/38 kHz L.P.F. is used
8 IF Narrow Distortion Adjustment	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	60 dBμ	Stereo (L) 1 kHz Main 90% Pilot 10%	Antenna Terminal	Distortion Meter	Output (L)	T1	Min Distortion	IF Band width "narrow"
9 IF Narrow Gain Adjustment	98.0 MHz (98.1 MHz)	FM SSG	98.0 MHz (98.1 MHz)	1st two Segments of Signal LED ON When wide	Stereo (L) 1 kHz Main 90% Pilot 10%	Antenna Terminal	-	-	VR 1	Equalization of 1st signal LED ON level at wide/narrow switching time	IF Band width "narrow"

AM

1 IF Adjustment	No. broadcasting	AM IF Sweep	-	No-IF Waveform Distortion Level	-	AM Antenna Terminal	Monitor Scope	R321	T305	Flat at Max. IF Waveform
2 522 kHz Tuning (530 kHz) Voltage	522 kHz (530 kHz)	-	-	-	-	-	Digital Voltmeter	R304	T303	1.2 V ± 500 mV
3 603 kHz Tracking (600 kHz)	603 kHz (600 kHz)	AM SSG	603 kHz (600 kHz)	Non-AGC Level	400 Hz, 30%	Loop Antenna	Electronic Voltmeter	Output (L)	T301	Max. Output Adjust the SG output not to work AGC
4 1404 kHz Tracking (1400 kHz)	1404 kHz (1400 kHz)	AM SSG	1404 kHz (1400 kHz)	Non-AGC Level	400 Hz, 30%	Loop Antenna	Electronic Voltmeter	Output (L)	TC301	Max. Output Adjust the SG output not to work AGC
5	Repeat items 3 and 4 to adjust the tracking									
6 Signal Indicator LED ON Level	999 kHz (1000 kHz)	AM SSG	999 kHz (1000 kHz)	48 dBμ/m	400 Hz, 30%	Loop Antenna	-	-	VR 301	1st Signal LED ON Both 1st and 2nd segments: on

Note: () U.S.A. and Canada Version.

TUNING METER JIG

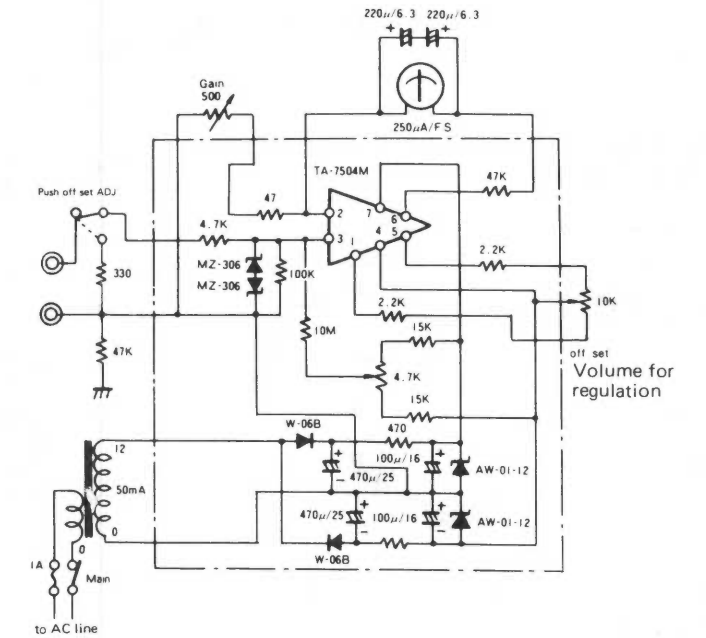
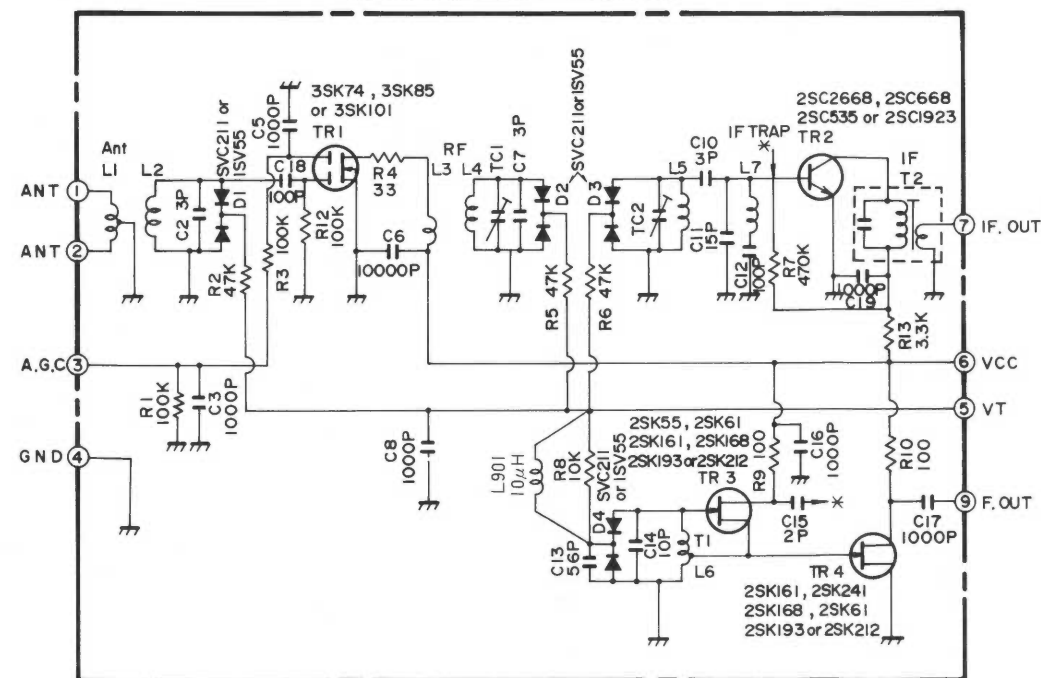
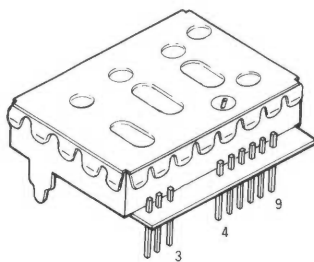


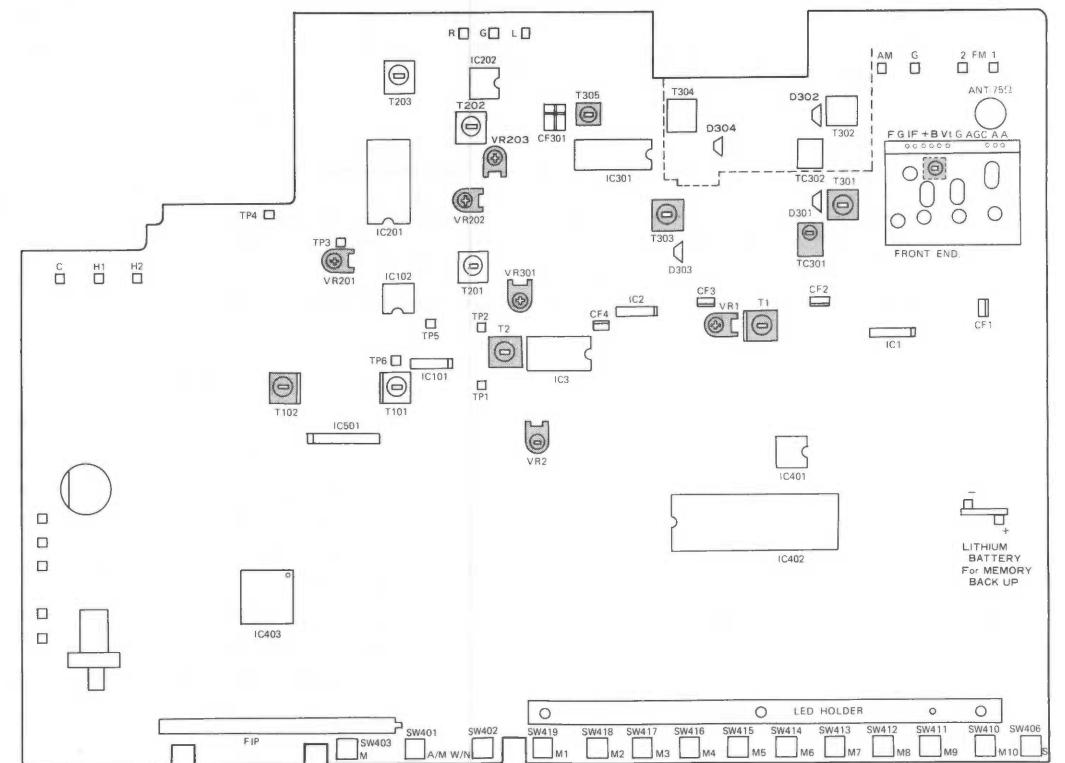
Fig. 12

SCHEMATIC DIAGRAM

Front end



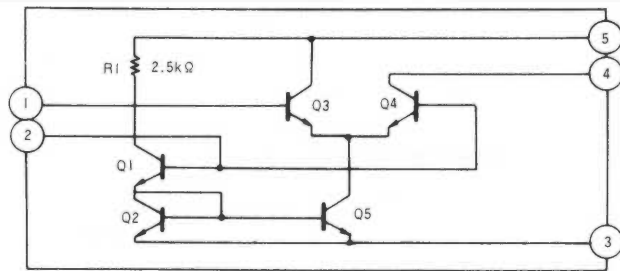
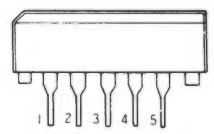
ETC0827 TUNER UNIT Alignment Points (Component Side)



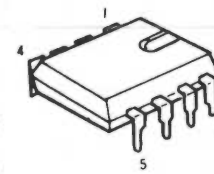
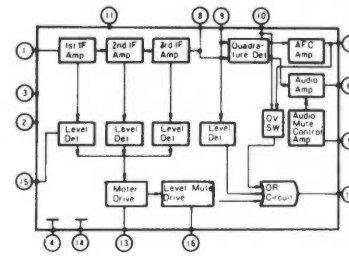
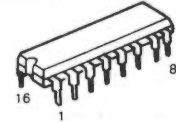
SEMICONDUCTORS

• IC's

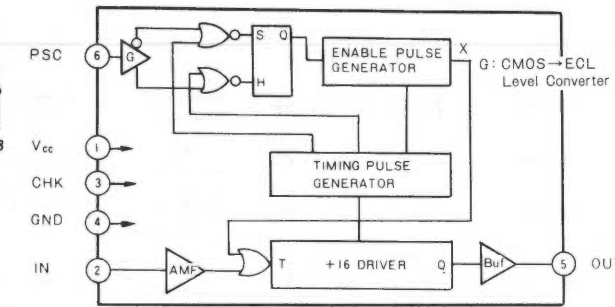
TA7060AP (Toshiba)



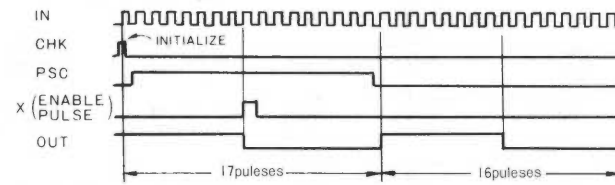
μPC1167C2 (NEC)



Block Diagram

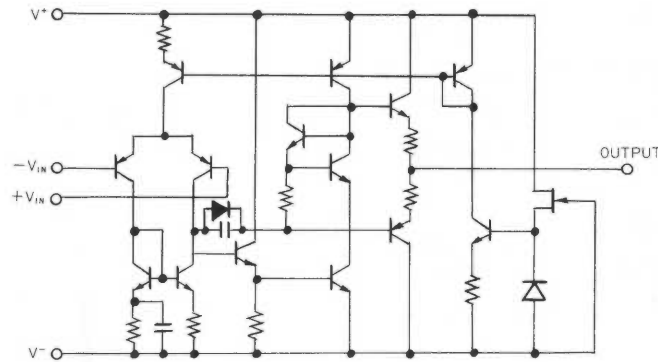
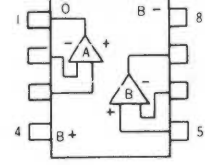
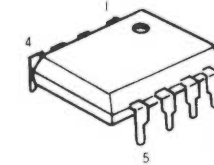


Timing Chart

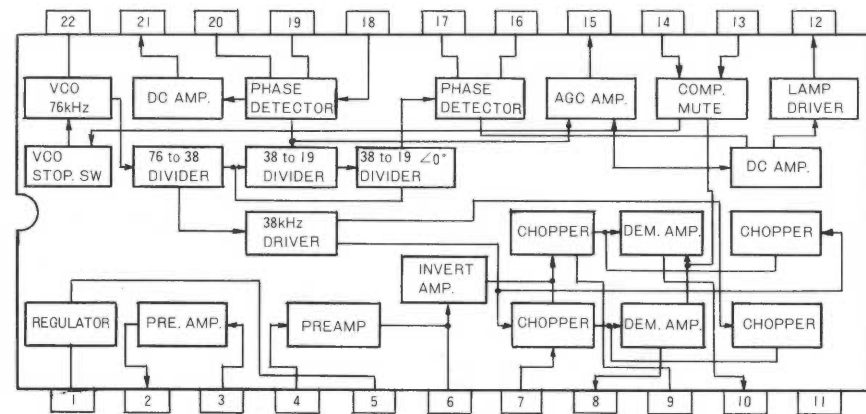
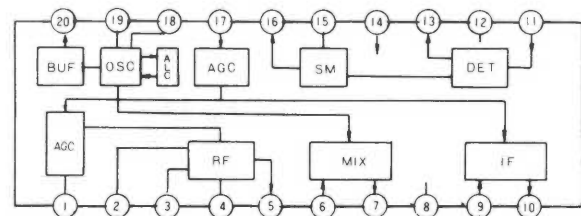
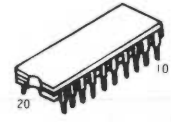


Pin No.	Symbol	Description
1	Vcc	Power supply pin, +5.0V (TYP.)
2	IN	Input pin
3	CHK	Check pin, normally connected to GND.
4	GND	Ground pin
5	OUT	Output pin
6	PSC	Frequency division ratio setting pin
7	NC	Reserved
8	NC	Reserved

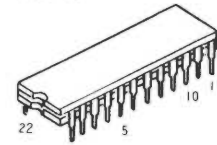
NJM4558D (JRC)
NJM2043DD (JRC)



LA1245 (Sanyo)

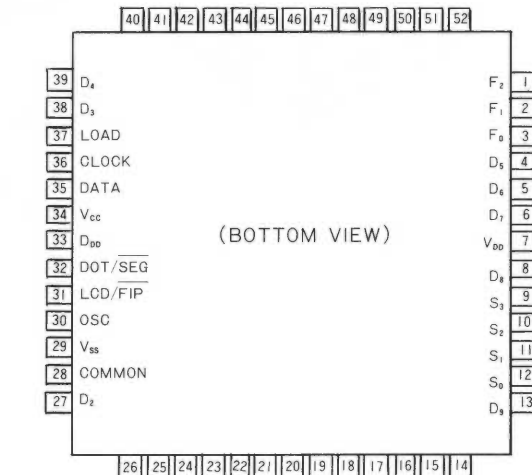
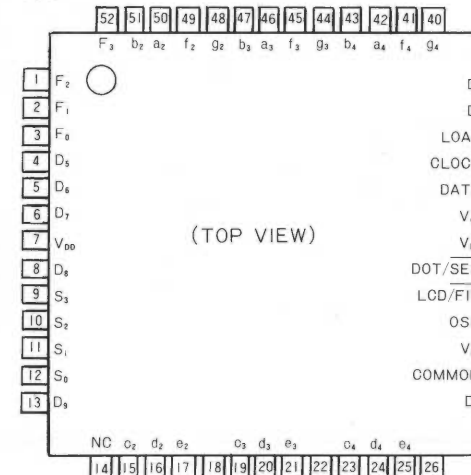
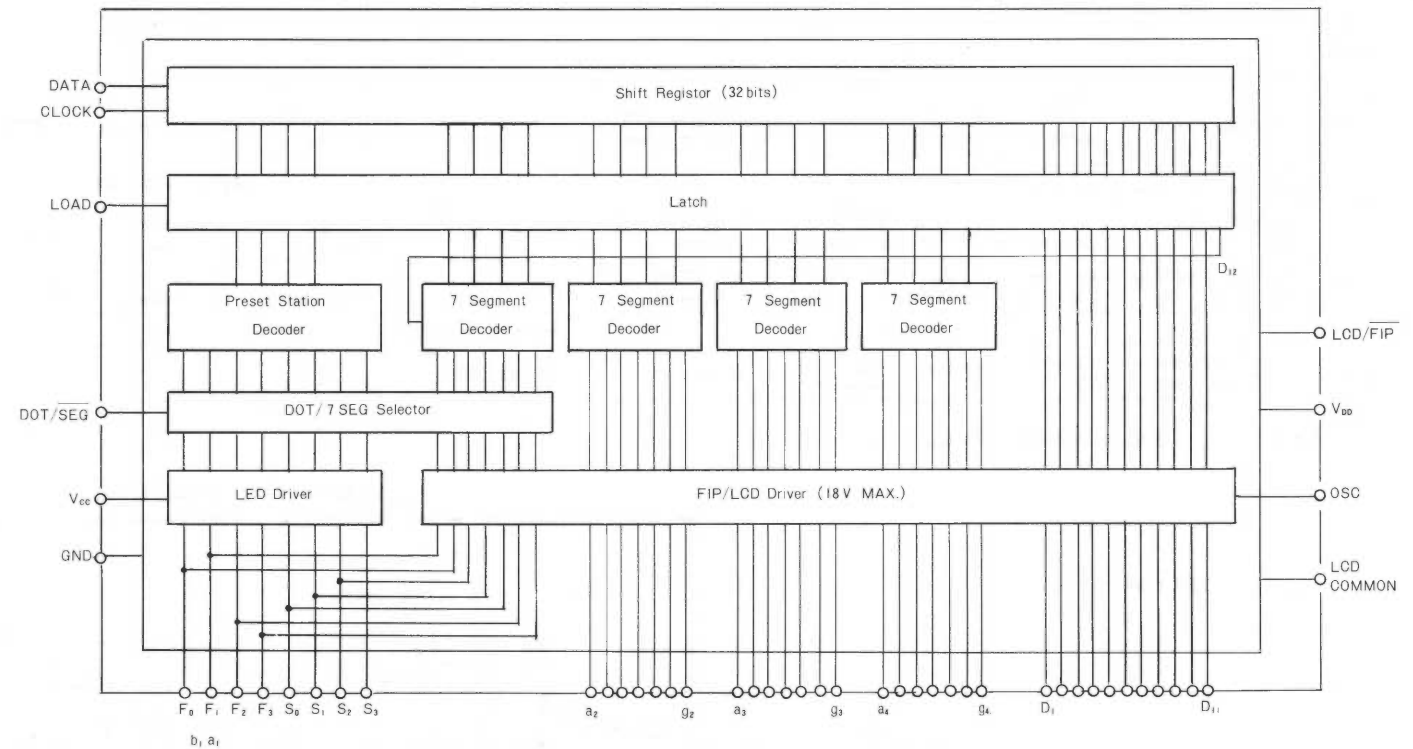


μPC1223C (NEC)

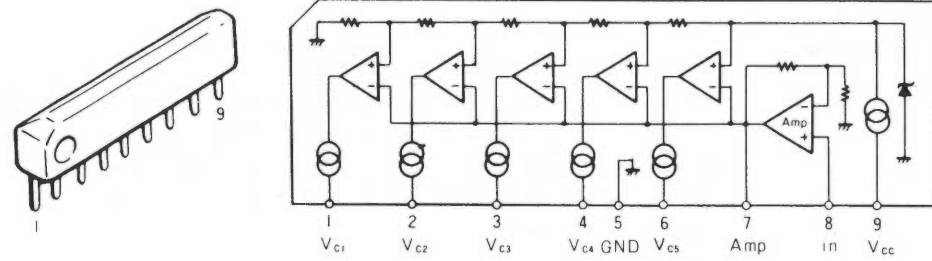


Pin No.	Description	Pin No.	Description
1	Vcc	12	ST. LAMP INDICATOR
2	PRE AMP. OUTPUT 1	13	ST-MONO SW & VCO STOP
3	PRE AMP. INPUT 1	14	MUTING SW
4	PRE AMP. INPUT 2	15	19 kHz CANCEL
5	BYPASS	16	LPF
6	PRE AMP. OUTPUT 2	17	LPF
7	POST AMP, INPUT	18	FILTER INPUT
8	L-ch OUTPUT	19	LPF
9	POST AMP, INPUT	20	LPF
10	R-ch OUTPUT	21	LPF
11	GND	22	OSC RC NETWORK

μPD6321G (NEC)



LB1403N
(SANYO)



μPD6321G

DESCRIPTION OF PINS

● **DATA, CLOCK**

These pins are used for data input to the shift register. Data is shifted one bit at a time at the rising edge of the pulse from the CLOCK pin.



The data signal is transmitted in sequence starting from bit 32 (MSB), and is completed after transmission of bit 1 (LSB). When the display is changed, transmission of the 32 bits of the data signal and the clock signal is required.

● **LOAD**

At the rising edge of the signal from the LOAD pin, the contents of the shift register (32 bits) are transferred to the latch circuit and the display operates.

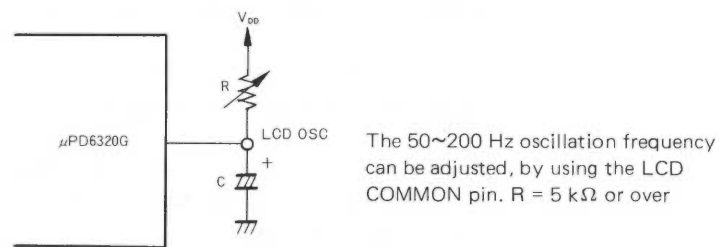
When the LOAD pin output is HIGH or LOW, the latch circuit retains its previous data, regardless of the contents of the shift register. When the LOAD pin output goes from LOW to HIGH, the display contents are changed.

● **LCD/FIP**

When this pin is HIGH (V_{DD}), connection to LCD is enabled. When it is LOW (GND), connection to FIP is enabled.

● **OSC**

This pin is used to determine the oscillating frequency of LCD. The oscillating frequency is determined by the value of the external CR. When LCD/FIP is LOW (FIP selected), no oscillation is generated. At this time the OSC pin should be fixed at LOW.



● **COMMON**

This pin is used for the LCD common signal output. The oscillating frequency is determined by the value of CR connected to the OSC pin.

When FIP is selected in correspondence with the output of the LCD/FIP pin, it is open.

● **DOT/SEG**

This pin is used to select either the LED dot display or the 7-segment display (FIP/LCD).

HIGH (V_{DD}) LED dot display

The data is bits 1 through 4 in the shift register is selected, and the data in bits 5 through 8 is ignored.

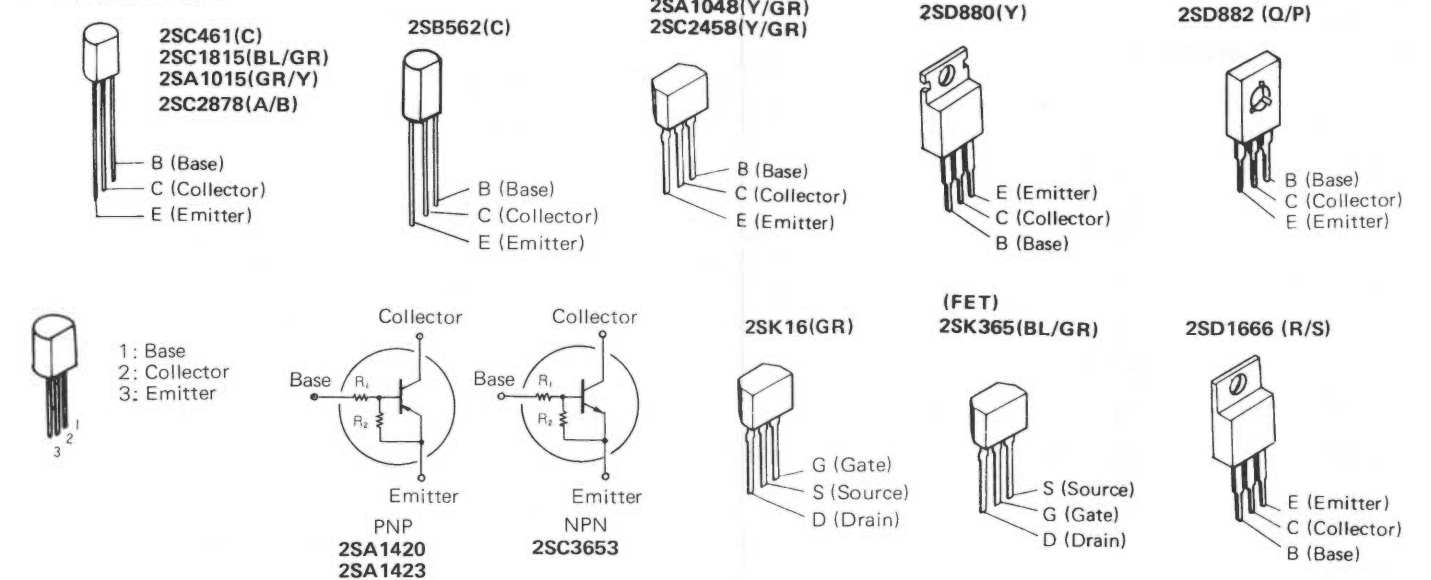
The display then consists of the flag ($D_1 \sim D_{11}$) + the 3 digits of the 7-segment display ($a_1 \sim g_1, a_2 \sim g_2, a_3 \sim g_3$) + the 16 point LED dot display.

LOW (GND) 7-segment display (FIP/LCD)

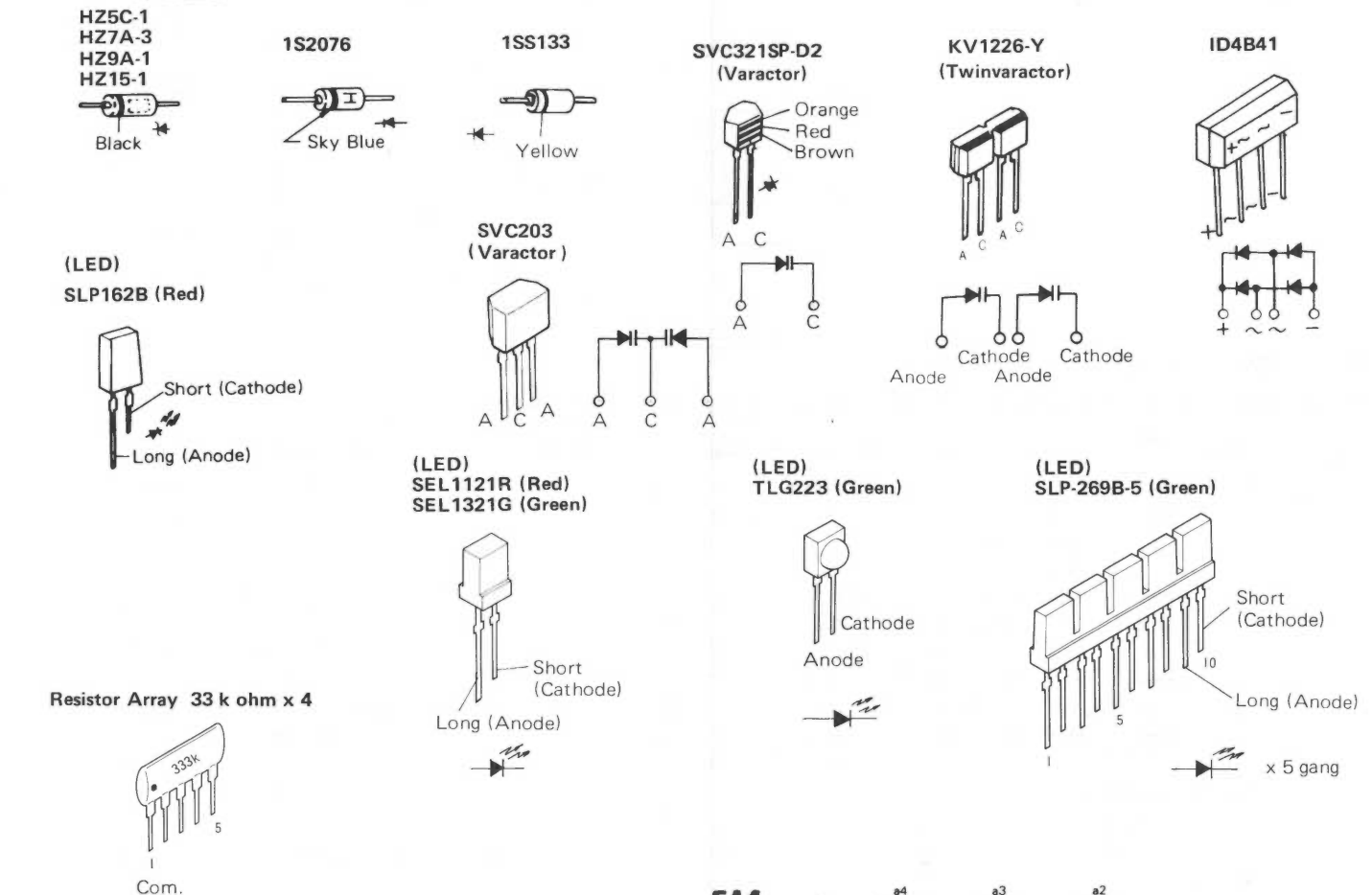
The data in bits 5 through 8 in the shift register is selected, and the data in bits 1 through 4 is ignored.

The display then consists of the flag ($D_1 \sim D_{11}$) + the 4 digits in the 7-segment display ($a_1 \sim g_1, a_2 \sim g_2, a_3 \sim g_3, a_4 \sim g_4$).

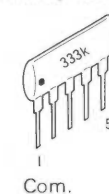
● **TRANSISTORS**



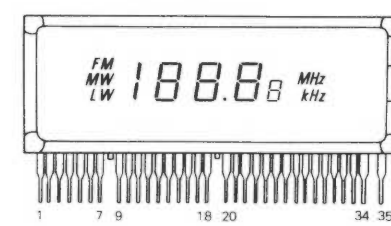
● **DIODES, LEDs**



Resistor Array 33 k ohm x 4

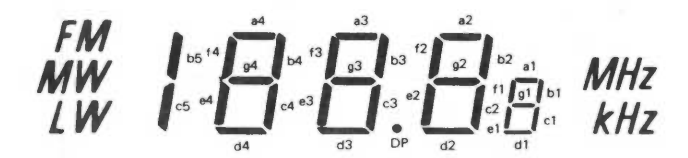


FIP7B8S (NEC)

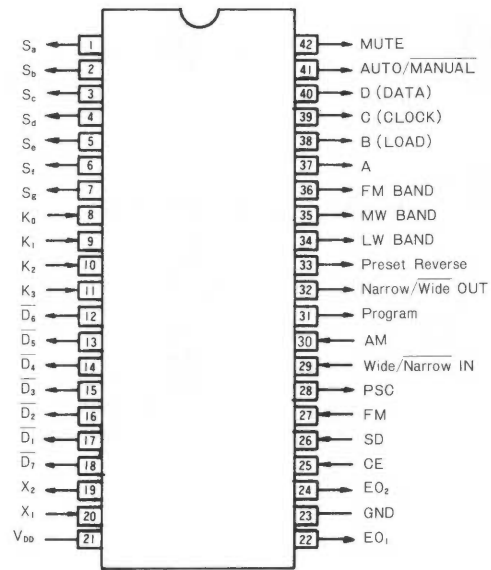


Connecting electrodes:

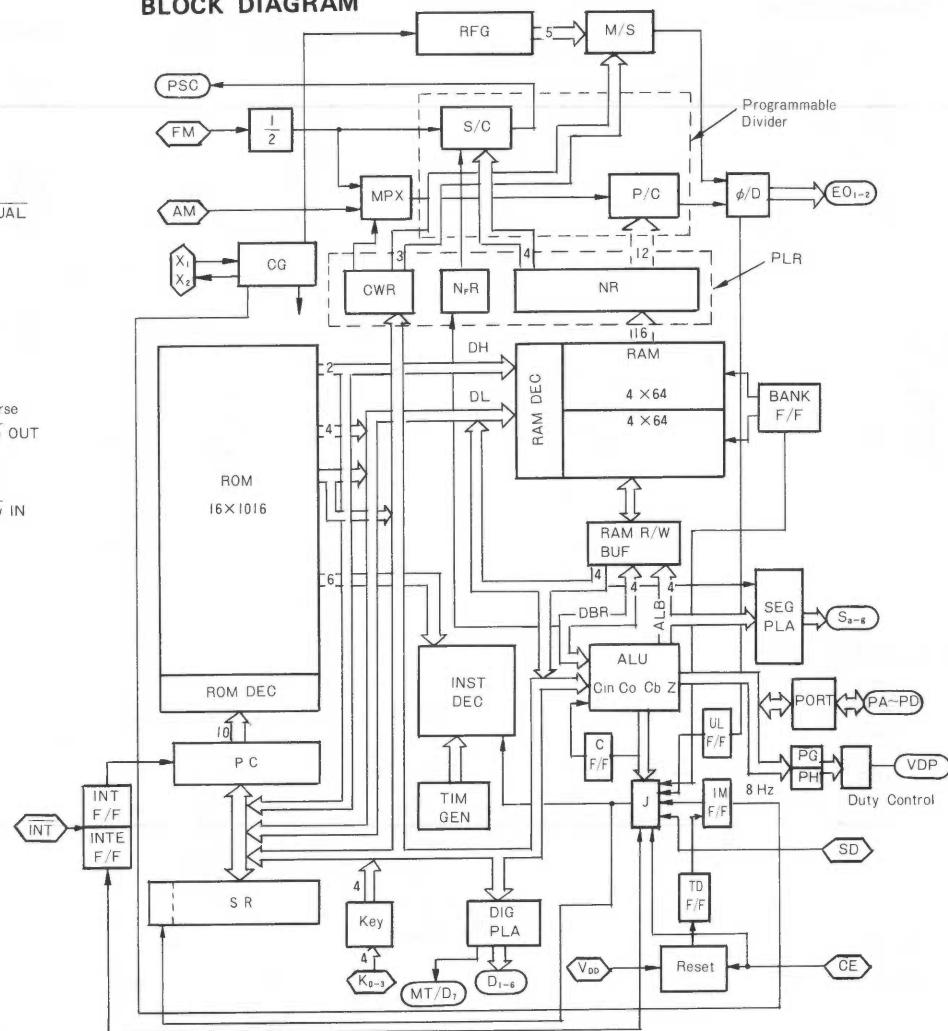
Number of terminal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Connecting electrode	F	P(a ₁)	P(a ₂)	P(a ₃)	P(a ₄)	P(a ₅)	NP	P(g ₁)	P(b ₁)	P(a ₁)	P(f ₁)	P(e ₁)	P(d ₁)	P(c ₁)	P(b ₁)	P(a ₁)	P(b ₁)	P(a ₁)
Number of terminal	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
Connecting electrode	NP	P(f ₁)	P(e ₁)	P(d ₁)	P(c ₁)	P(b ₁)	P(a ₁)	P(g ₁)	P(MHz)	P(MHz)	P	[FM _d] a, 1	P(MW)	P(LW)	G	G	F	



**μPD1704C-025
(NEC)
PIN OUTLINE DIAGRAM**



BLOCK DIAGRAM



FUNCTION OUTLINE

Reception frequencies, channel space, reference frequencies, and intermediate frequencies

Region	Band	Item	Frequency range	Channel space	Reference frequencies	Middle frequencies
Europe	FM	87.50 ~ 108.00 MHz	50 kHz	25 kHz	10.650, 10.675, 10.700, 10.725 MHz	
		MW	522 ~ 1611 kHz	9 kHz	9 kHz	450 kHz
		LW	146 ~ 353 kHz 144 ~ 351 kHz	9 kHz	1 kHz	
U.S.A.	FM	87.9~107.9 MHz	200 kHz	25 kHz	10.650, 10.675, 10.700, 10.725 MHz	
		MW	530 ~ 1620 kHz	10 kHz	10 kHz	450 kHz
Japan	FM	76.1 ~ 89.9 MHz	100 kHz	25 kHz	-10.675, -10.700, -10.750 MHz	
		MW	522 ~ 1611 kHz	9 kHz	9 kHz	450 kHz
South Africa	FM	87.50 ~ 108.00 MHz	50 kHz	25 kHz	-10.675, -10.700, -10.725, -10.750 MHz	
		MW	522 ~ 1611 kHz	9 kHz	9 kHz	450 kHz

Station Selection Function

- Auto Up/Down Tuning (Sawtooth wave mode)**
When there is a high-level input at the SD pin, the auto tuning action will be stopped and the reception of the station will continue.
- Manual Up/Down Tuning (Sawtooth wave mode)**
Steps are sent by the momentary switch. If the switch is pressed down for more than 0.5 seconds, tuning continues until the switch is released.
- Preset, memory call**
The 10-key keypad is used to randomly preset or enter in memory 20 stations for FM/MW/LW. The initial setting switch can be used to select 16 stations with the 8 key, 14 stations with the 7 key, and 12 stations with the 6 key.
- Preset memory scan (Up direction/sawtooth wave mode)**
The contents of preset, station and memory are received for 5 seconds each. At present, when preset, station, or memory is being received, reception is performed in order from the next station. When the last channel is being received, reception is performed in order from M1.
- Auto preset memory**
Search is performed in the up direction for the station for which there is a high level input at the SD terminal. Preset, station, and memory are read in order.

DESCRIPTION OF PINS

Pin No.	Symbol	Pin Name	Description
1 ~ 7	Sa~Sg	Segment output	These pins are used to output the display segment signal for the dynamic display and the key return signal source. They are active high, open drain type output, and withstand 30 V maximum. This allows direct connection to the FIP (fluorescent display tube) segment pin. A pull-down resistor is required.
8~11	K0~K3	Key return signal input	These pins are used for the key return signal input from an externally connected key matrix. The key return signal source is the segment pins Sa ~ Sg and D1 and D2.
12~18	D1~D7	Digit output	These pins are used to output the display digit signal for the dynamic display. They are active low. For the connection of the FIP (fluorescent display tube), a signal stage buffer, such as a PNP transistor (2SA733), is required. (For details, refer to 3-1 Display Connection Diagrams.) D1 and D2 are the key return signal source for the initialization set diode matrix.
19	X1 X2	Quartz oscillating element	These pins are used to connect the quartz oscillating element. A 4.5 MHz quartz crystal should be connected.
21	VDD	Power supply input	This pin is used for the device power source. When the device is operating, a voltage of 5 V ± 10% is supplied. In the state in which the contents of memory are retained (for device CLOCK STOP, for CE=LOW), the voltage can decrease down to 2.5 V. However, the rise time of VDD must be 500 ms or less (0 → 4.5V). If the rise time is too long, initialization may not be correctly performed.
22 24	EO1 EO2	Error output	These pins are used for the charge pump output of the phase detector that constructs PLL. If the division of the oscillating frequency is higher than the reference frequency, the output from these pins is HIGH. If it is lower than the reference frequency, the output from the pins is LOW. The same signal is simultaneously output to EO1 and EO2; therefore connection can be made to the LPF (low pass filter) of either FM, MW or LW.
23	GND	Ground	Connect this pin to the system ground.
25	CE	Chip enable	This pin is used for the device selection signal input. It is HIGH during normal operation of the device, and LOW when the device is not being used. CE = High . . . Normal operation CE = Low . . . Display off, PLL operation halt, built-in clock generator halt Current consumption: below 10 μA (5V) A high level or low level of less than 134 μs cannot be received.
26	SD	Broadcasting station detection signal input	This pin is used during auto tuning (AUTO UP/DOWN) for the input that identifies whether a broadcasting station signal has been received. At a HIGH level input, auto tuning stops. An input is required within 75 ms after PLL is locked.
27	FM	FM broadcasting signal input	This pin is used for the FM programmable counter input. The FM station oscillation output (VCO) is frequency divided into 1/16 or 1/17 at prescaler μPB553AC, and this output is used as the input. Because of the built-in AC amp, cut the DC component with a condenser before input.

Pin No.	Symbol	Pin Name	Description
28	PSC	Pulse swallow control	This pin is used to output the signal to select the frequency division ratio for the prescaler, when the pulse swallow system is used for frequency division (for FM), it should be connected to the dedicated prescaler μ PB553AC PSC pin. The selected frequency division ratios for μ PB553AC are 1/16 and 1/17.
29	Wide / Narrow IN	IF band information input	This pin is used to input information on whether the IF bandwidth is wide or narrow. During auto memory, the state of this pin is read in and stored in memory. It is HIGH for wide and LOW for narrow. This pin cannot be used by setting it to remain LOW.
30	AM	AM broadcasting signal input	This pin is used for the AM programmable counter input. The output for the MW and LW broadcasting oscillation (VCO) is input. Because of the built-in AC amp, cut the DC component with a condenser before input.
31	PROGRAM	Program selection signal output	This pin is used for the output to indicate whether program mode is selected or not. In program mode, a HIGH level is output. Otherwise a LOW level is output. The output level is switched over each time the PROGRAM key is pressed. (Refer to Note.)
32	Narrow/ Wide OUT	IF bandwidth selection output	This pin is used for the output to select wide or narrow IC bandwidth. It outputs at HIGH level for narrow, and at LOW level for wide. In auto tuning mode, the tuning operation is performed using wide. When a broadcasting station is tuned in (a HIGH level signal is input to the SD pin), the wide/Narrow IN pin information is detected and the state of that pin is set. (Refer to Note.)
33	Preset Reverse (SHIFT)	Preset reverse indicator output	This pin is used for the output to indicate whether the preset keys (M1/M11~M10/M20) are set for a front station or a back station. When a front station (M11~M20) is selected, a HIGH level is output. When a back station (M1~M10) is selected, a LOW level is output.
34 35 36	LW BAND MW BAND FM BAND	Band selection signal output	This terminal is used to output the tuner band selection signal. A HIGH level signal is output from each pin in correspondence with the selected bandwidth.

Pin No.	Symbol	Pin Name	Description																																																												
37 38 39 40	A B(LOAD) C(CLOCK) D(DATA)	Preset station display output	<p>(i) For dynamic display The BCD code used to indicate the preset station is output statically. The outputs that correspond to the preset stations are shown in the table below.</p> <table border="1"> <thead> <tr> <th>PRESET STATION</th> <th>D</th> <th>C</th> <th>B</th> <th>A</th> </tr> </thead> <tbody> <tr> <td>NO CH SPECIFICATION</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>M1</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>M2</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>M3</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>M4</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>M5</td> <td>0</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>M6</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>M7</td> <td>0</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>M8</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>M9</td> <td>1</td> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>M10</td> <td>1</td> <td>0</td> <td>1</td> <td>0</td> </tr> </tbody> </table> <p>The preset station dot display, which uses LEDs, is enabled by connection of μPD6322C (LED dot display driver).</p> <p>(ii) For static display The display data is output to μPD6320G/μPD6321G (FIP/LCD static display drive). Connect the LOAD, CLOCK and DATA pins to the μPD6320G/21G LOAD, CLOCK and DATA pins. When the static display is used, the preset station display is performed by the static display driver.</p>	PRESET STATION	D	C	B	A	NO CH SPECIFICATION	0	0	0	0	M1	0	0	0	1	M2	0	0	1	0	M3	0	0	1	1	M4	0	1	0	0	M5	0	1	0	1	M6	0	1	1	0	M7	0	1	1	1	M8	1	0	0	0	M9	1	0	0	1	M10	1	0	1	0
PRESET STATION	D	C	B	A																																																											
NO CH SPECIFICATION	0	0	0	0																																																											
M1	0	0	0	1																																																											
M2	0	0	1	0																																																											
M3	0	0	1	1																																																											
M4	0	1	0	0																																																											
M5	0	1	0	1																																																											
M6	0	1	1	0																																																											
M7	0	1	1	1																																																											
M8	1	0	0	0																																																											
M9	1	0	0	1																																																											
M10	1	0	1	0																																																											
41	AUTO MANUAL	Auto/Manual indicator output	This pin is used to output the signal indicating whether the tuning mode is automatic or manual. During auto tuning, a HIGH level is output. In manual mode, a LOW level is output. (See Note.)																																																												
42	MUTE	Mute output	<p>This terminal is used for the muting output, which is used to eliminate shock vibrations and noise when the PLL lock is released. It is active high.</p> <p>Mute is output in the following modes:</p> <ul style="list-style-type: none"> ○ Manual up and down ○ Auto up and down ○ Preset memory call ○ Band selection ○ Preset scan ○ Auto memory read-in ○ IF band width selection ○ Display ○ CE pin: Low \rightarrow High <p>For details on the timing, refer to 4.2 Mute Timing Charts.</p>																																																												

Note: A pull-down resistance is needed because the PROGRAM (31), Narrow/WIDE OUT (32) Preset Reverse (33) and AUTO/MANUAL (41) terminals have high impedance at reset. (When V DD is turned ON, the CE terminal goes from Low to High.)

PRINTED WIRING BOARD PATTERNS AND PARTS LIST
ETC0827 TUNER UNIT PARTS LIST (for E2 and EA)

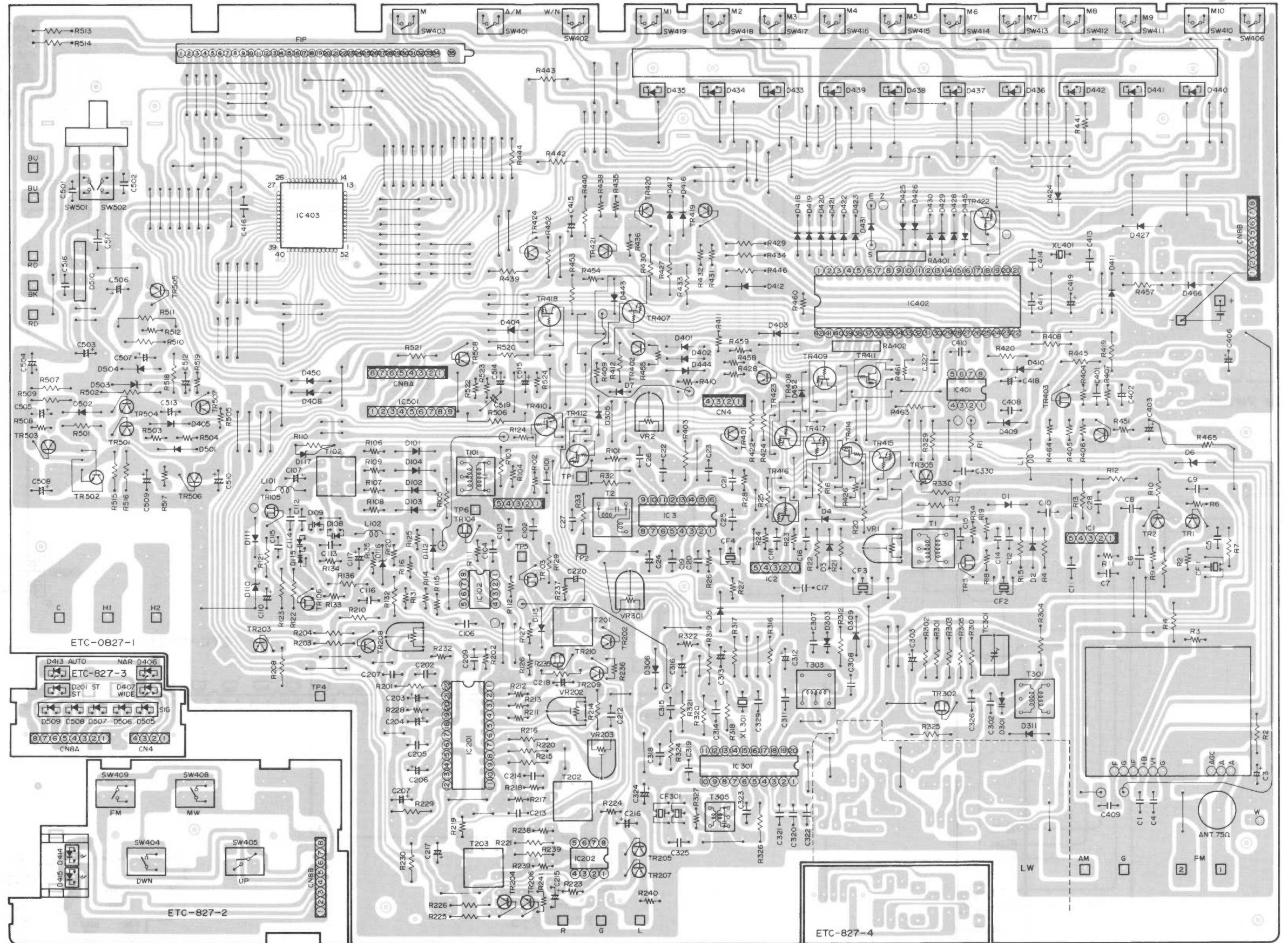
Ref. No.	Part No.	Part Name & Descriptions	Ref. No.	Part No.	Part Name & Descriptions
SEMICONDUCTORS					
IC001	2630099007	TA-7060AP (Toshiba) IC	D412	2760236001	HZ5C-1 Zener
IC002	2630383001	μPC1167C2 (NEC) IC	D413	3939261014	SEL1321G (Green) LED
IC101	2630099007	TA-7060AP (Toshiba) IC	D414	3939320007	TLG223 (Green) LED
IC102	2650037007	NJM-2043DD (JRC) IC	415		
IC201	2630397000	μPC1223C (NEC) IC	D416	2760049008	1S2076 Diode
IC302	2630081002	NJM4558D (JRC) IC	~429		
IC301	2630145003	LA1245 (Sanyo) IC	D433	3939307004	SLP162B (Red) LED
IC401	2630162002	μPB-553AC (NEC) IC	~442		
IC402	2620449007	μPD1704C-025 (NEC) IC	D443	2760049008	1S2076 Diode
IC403	262045009	μPD6321G (NEC) IC	~446		
IC501	2630371000	LB1403N (Sanyo) IC	D450	2760049008	1S2076 Diode
TR001	2730025023	2SC461(C) Transistor	D452	2760049008	1S2076 Diode
TR003	2750051006	2SK161(GR) FET	D501	2760049008	1S2076 Diode
TR101			D502	2760253014	HZ15-1 Zener
TR102			D503	2760051067	HZ7A-3 Zener
TR103			504		
TR104	2750048019	2SK381(B)/(C) FET	D505	3939321006	SL269B-5 (Green) LED
TR105			~509		
TR106	2750051006	2SK161(GR) FET	D510	2760422007	1D4B41 Diode
TR201	2710194003	2SC1048(Y/GR) Transistor	RESISTORS (not included Carbon Film ±5%, 1/6W, 1/4W Type)		
TR202	2730198001	2SC1815(BL/GR) Transistor	△ R025	2412314007	100 ohm ±5% 1/4W Carbon Film (NBF)
TR203	2710194000	2SA1048(Y/GR) Transistor	△ R030	2412321016	22 ohm ±5% 1/4W Carbon Film (NBF)
TR204	2730253015	2SC2878(A)/(B) Transistor	△ R103	2412314007	100 ohm ±5% 1/4W Carbon Film (NBF)
TR208	2710194000	2SA1048(Y/GR) Transistor	R427	2410181009	680 ohm ±5% 1/2W Carbon Film
TR209	2730198015	2SC1815(B) Transistor	R430	2410181009	680 ohm ±5% 1/2W Carbon Film
TR210	2750048019	2SK381(B)/(C) FET	△ R445	2412314007	100 ohm ±5% 1/4W Carbon Film (NBF)
TR302	2750051006	2SK161(GR) FET	△ R502	2440028022	82 ohm ±5% 1W Metal Oxide (NBF)
TR305	2730198031	2SC1815(BL/GR) Transistor	△ R506	2440029021	100 ohm ±5% 1W Metal Oxide (NBF)
TR401	2730222004	2SC2458(Y/GR) Transistor	△ R511	2440033020	220 ohm ±5% 1W Metal Oxide (NBF)
TR403	2750053004	2SK365(BL/GR) FET	VR001	2116057000	Semi Fixed Resistor 1 k ohm
TR404	2730198031	2SC1815(BL/GR) Transistor	VR002	2116057026	Semi Fixed Resistor 20 k ohm
TR407	2710199005	2SA1420 Transistor	VR202	2116057039	Semi Fixed Resistor 100 k ohm
TR408	2710198006	2SA1423 Transistor	203		
TR409	2730328005	2SC3653 Transistor	VR301	2116057026	Semi Fixed Resistor 20 k ohm
TR410	2710198006	2SA1423 Transistor	RA401	2462021065	Resistor Array 30 k ohm x 4
TR411	2730328005	2SC3653 Transistor	CAPACITORS		
TR414	2710198006	2SA1423 Transistor	C001	2531024003	0.01μF +80% -20% 50V Ceramic
TR415	2730328005	2SC3653 Transistor	C003	2544132005	10μF 16V Electrolytic
TR416	2710198006	2SA1423 Transistor	C004	2539031027	0.1μF ±10% 25V Ceramic
TR417	2730328005	2SC3653 Transistor	C005	2531024003	0.01μF +80% -20% 50V Ceramic
TR419	2730198015	2SC1815(BL) Transistor	~012		
TR421	2710102034	2SA1015(GR/Y) Transistor	C014	2531024003	0.01μF +80% -20% 50V Ceramic
TR422	2710199005	2SA1420 Transistor	C015	2533623004	68PF ±5% 50V Ceramic
TR423	2730198031	2SC1815(BL/GR) Transistor	C016	2531024003	0.01μF +80% -20% 50V Ceramic
TR424	2730222004	2SC2458(Y/GR) Transistor	~017		
TR501	2730198031	2SC1815(BL/GR) Transistor	C024	2544146004	1μF 50V Electrolytic
TR502	2740065002	2SD880(Y) Transistor	C025	2531024003	0.01μF +80% -20% 50V Ceramic
TR503	2730198031	2SC1815(BL/GR) Transistor	026		
TR505	2720025004	2SB562(C) Transistor	C027	2531025002	0.022μF +80% -20% 50V Ceramic
TR506	2740078031	2SD882(Q/P) Transistor	C028	2531024003	0.01μF +80% -20% 50V Ceramic
TR507	2740112007	2SD1666(R)/(S) Transistor	C029	2531025002	0.022μF +80% -20% 50V Ceramic
TR508	2710102034	2SA1015(GR/Y) Transistor	C101	2531024003	0.01μF +80% -20% 50V Ceramic
D001	2760049008	1S2076 Diode	103		
~005			C104	2533606005	13PF ±5% 50V Ceramic
D006	2760185014	HZ4B-3 Zener	C106	2533625002	82PF ±5% 50V Ceramic
D007	2760401002	1SS133 Diode	C107	2544162020	470μF ±20% 10V Electrolytic
D101	2760049008	1S2076 Diode	C110	2544136001	100μF 16V Electrolytic
~104			C112	2534342041	5PF ±0.25PF 50V Ceramic
D108	2760421008	KV1226-Y Varactor	113		
D109	2760218032	HZ9A-1 Zener	C114	2533615009	33PF ±5% 50V Ceramic
D110	2760049008	1S2076 Diode	115		
D111	2760049008	1S2076 Diode	C116	2544214020	1μF 50V Electrolytic (B.P)
D114	2760425004	SVC-203 Varactor	C117	2544140000	4.7μF 35V Electrolytic
D116	2760236031	HZ5C-1 Zener	C201	2556089007	390PF ±5% 50V Plastic Film
D117	3939261001	SEL1121R (Red) LED	C202	2531055030	2700PF ±10% 50V Ceramic
D201	2760302004	SVC321SP-DZ Varactor	C203	2544140000	4.7μF 35V Electrolytic
D303	2760302004	SVC321SP-DZ Varactor	C204	2544145005	0.47μF 50V Electrolytic
D305	2760049008	1S2076 Diode	C205	2531055027	820PF ±10% 50V Ceramic
306			C206	2544132005	10μF 16V Electrolytic
D311	2760049008	1S2076 Diode	C207	2544140000	4.7μF 35V Electrolytic
D401	2760049008	1S2076 Diode	C209	2539031001	0.047μF ±10% 25V Ceramic
~405			C212	2539030044	4700PF ±10% 25V Ceramic
D406	3939261014	SEL1321G (Green) LED	C213	2551120026	0.0015μF ±5% 50V Plastic Film
407			214		
D408	2760049008	1S2076 Diode	C215	2544145005	0.47μF 50V Electrolytic
~411			216		
			C217	2544130007	100μF 10V Electrolytic
			C218	2544136001	100μF 16V Electrolytic

Ref. No.	Part No.	Part Name & Descriptions	Ref. No.	Part No.	Part Name & Descriptions	Q'ty
CF301	2610065006	AM Ceramic Filter (SFZ450F3L)				
SWITCHES						
SW401	2124586000	Tact Switch				
~403						
SW404	2124407008	Tact Switch				
405						
SW406	2124586000	Tact Switch				
SW408	2124407008	Tact Switch				
409						
SW410	2124586000	Tact Switch				
~419						
SW501	2124598001	1P Push Switch (Power)				
502						
E.U.P.						
	3934011007	FIP7A8S FLD				
	2160060001	Front End				
	3940005007	Lithium Battery				
	3990019001	X-tal (4.5 MHz)				
XL401						
OTHER PARTS						
	2221285000	P.W. Board				1
	2090008146	Jumper Wire P = 5mm				50
	2090008120	Jumper Wire P = 10mm				160
	EP-5667H1	Terminal Pin				20
	4170124003	Mini Radiator				1
	4730354019	Tapping Screw (2) 3x8				1
	2050185041	4P Wire Holder				1
	2050185083	8P Wire Holder				1
	2042150026	8PEH Connector Cord				1
	2042150013	8PEH Connector Cord				1
	2036156010	4P Connector Cord				1
	2050233087	8P Connector Cord				2
	2050233045	4P Connector Cord				1
	2030262007	Ant Pin Cord Ass'y				1
	1460802009	LED Holder (Signal)				1
	1460803008	LED Holder (Shift)				1
	1460801107	LED Holder (Preset)				1
	4737500028	Tapping Screw (P) 3x8				3
	4410658006	Switch Bracket				1
	4737002005	Tapping Screw (S) 3x6				2
	4737009008	Flat Head Tapping Screw (S) 3x6				1

ETC0827B TUNER UNIT P/List (for EU)
(Same as ETC0827 (for E2) except the followings.)

Ref. No.	Part No.	Part Name & Descriptions
SEMICONDUCTORS		
D429	2760049008	1S2076 Diode (Delete)
D430	2760049008	1S2076 Diode (Add)
431		
RESISTORS		
R033	2412123007	20 k ohm ±5% 1/4W Carbon Film (Change)
CAPACITORS		
C213	2551120042	0.0022μF ±5% 50V Plastic Film (Change)
214		
C902	2531024003	0.01μF +80% -20% 50V Ceramic (Add.)
SWITCHES		
SW501	2123360002	Power Switch (Change)
502		

ETC0827 TUNER UNIT



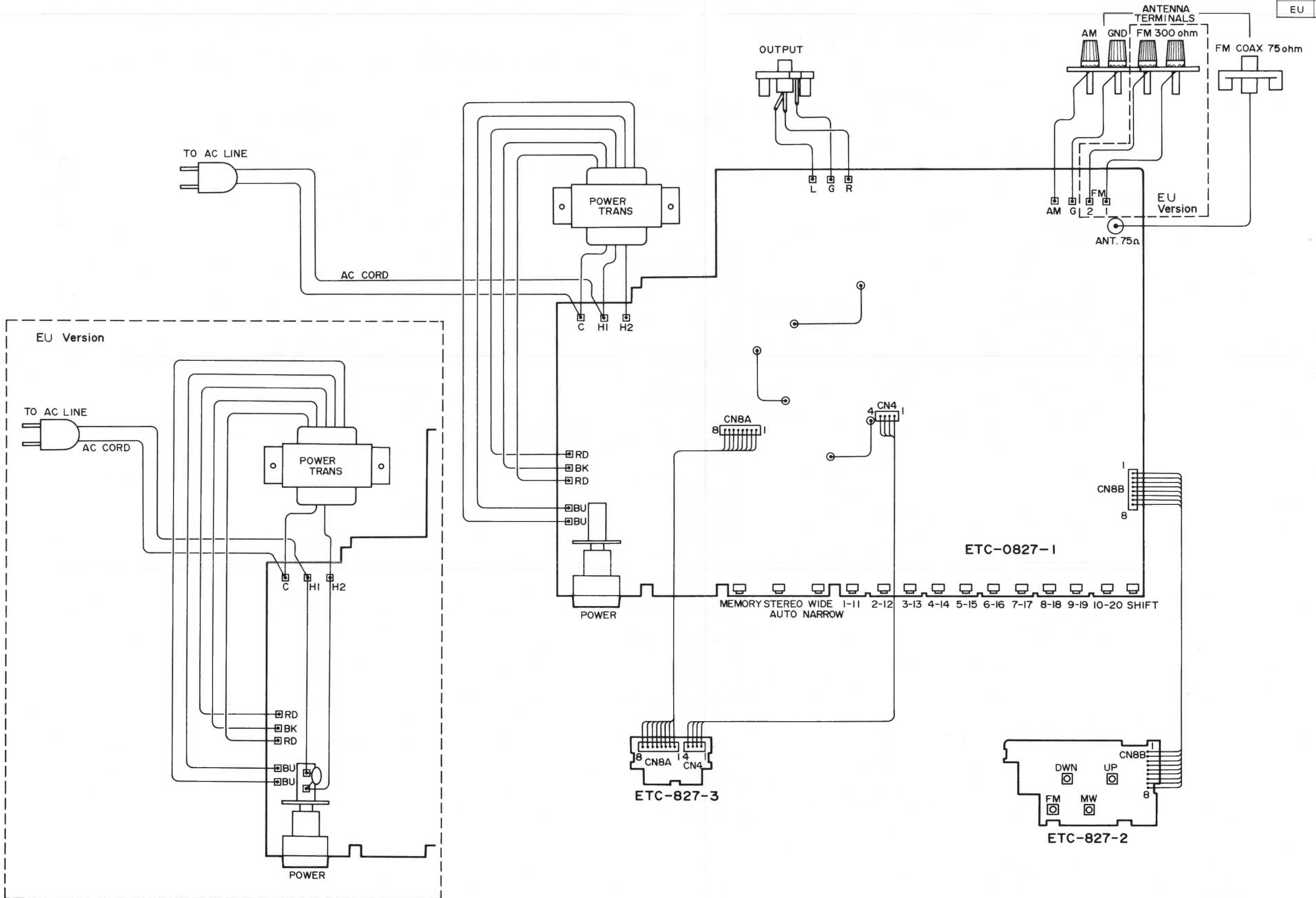
Note:

Version	Diode	R33	C213, 214
E2, EA	D429	27 k ohm	0.0015μF
EU	D430, 431	20 k ohm	0.0022μF

WIRING DIAGRAM
(This figure is specifications of E2 Version)

TUNER UNIT

E2, EA	ETC0827
EU	ETC0827B

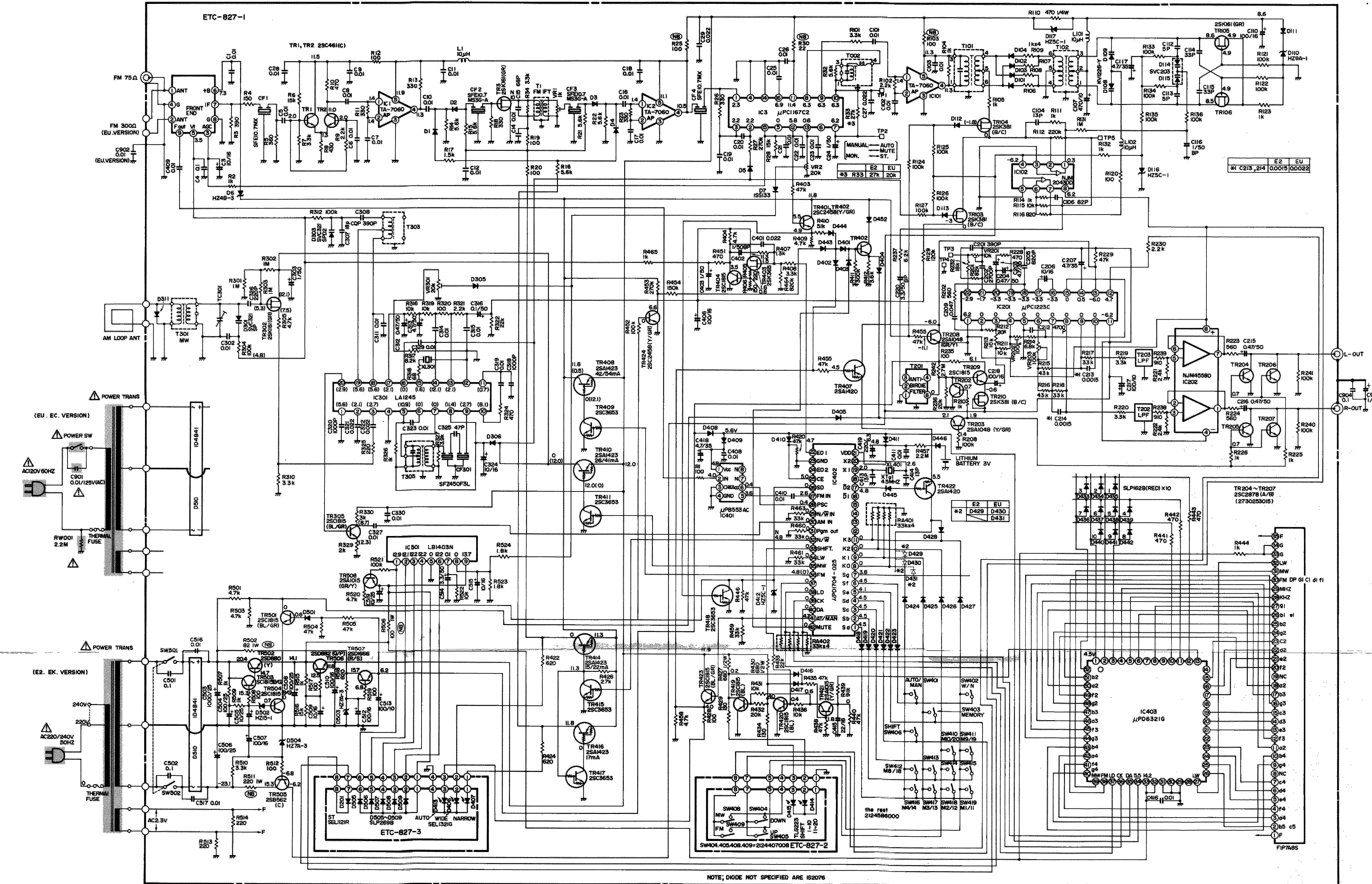


SCHEMATIC DIAGRAM

Means important safety item, which must be replaced, when necessary, by a part specified or meeting the specification by the manufacturer.

1 2 3 4 5 6 7 8 9 10 11 12

UNIT NO	
ETC-827	E2
ETC-827B	EU

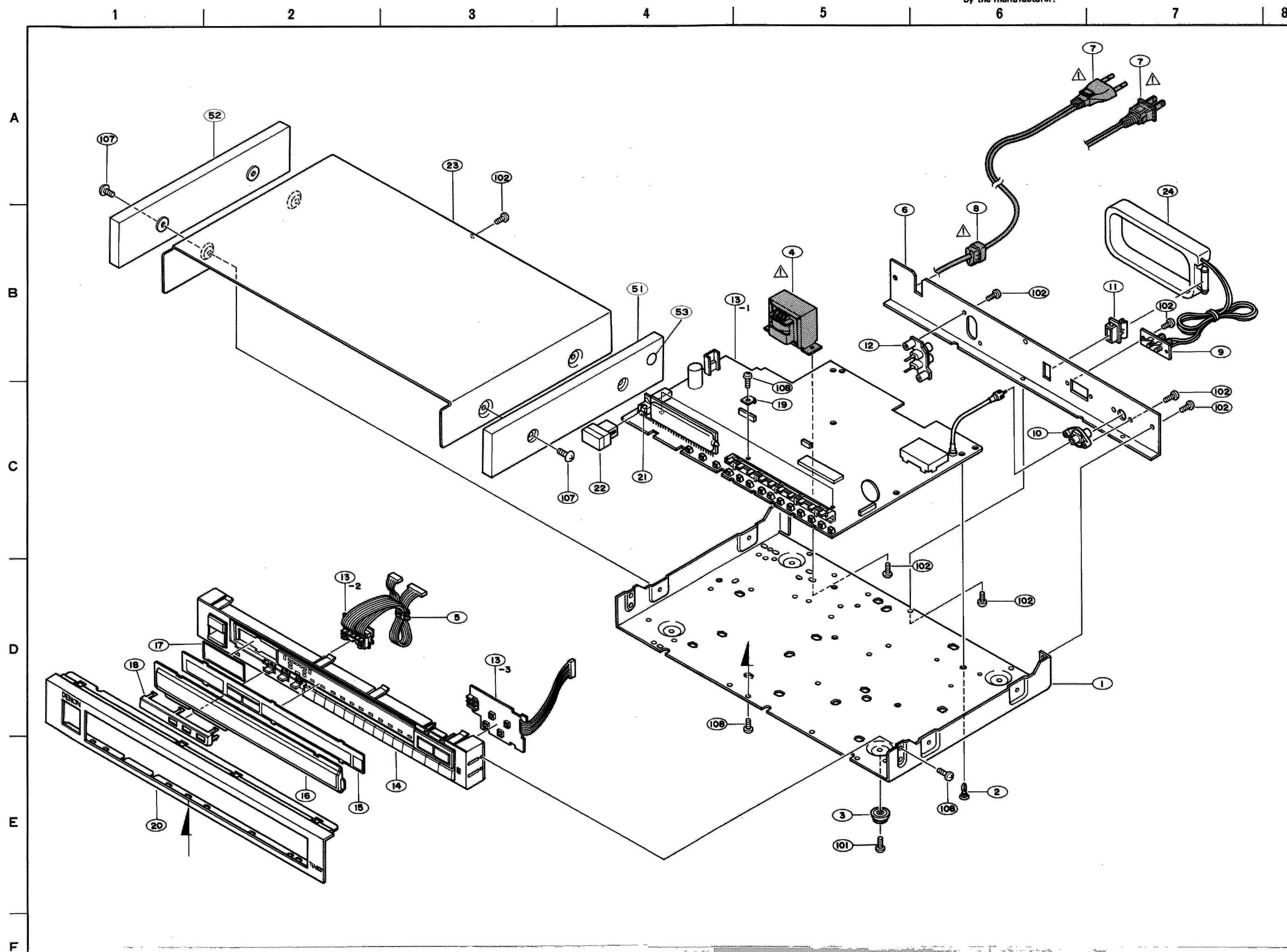


• Voltage value is at FM 98 MHz, M1 preset.
 N: IF Band Narrow.
 Voltage value is at AM 999 kHz, M2 preset.
 Voltage value in parenthesis is at AM.
 • Unspecified diodes are IS2076.

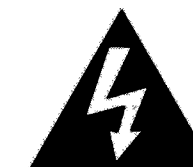
NOTES
 ALL RESISTANCE VALUES IN OHM K = 1,000 OHM M = 1,000,000 OHM
 ALL CAPACITANCE VALUES IN MICRO FARAD P = MICRO-MICRO FARAD
 EACH VOLTAGE AND CURRENT ARE MEASURED AT NO SIGNAL INPUT CONDITION.
 CIRCUIT AND PARTS ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

EXPLODED VIEW OF CHASSIS AND CABINET (This figure is specifications of E2 Version.)

⚠ Means important safety item, which must be replaced, when necessary, by a part specified or meeting the specification by the manufacturer.



DENON



CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN



CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.



The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user of the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

ADDENDUM LIST

Ref. No.	Part Name & Descriptions	Part No.		
		EU for U.S.A.	EC for Canada	EA for Australia
⚠ 4	Power Trans	2335526105	2335538009	2335525106
6	Back Panel	1050668008	1050668008	1050671103
⚠ 7	AC Cord	2062039004 (Polarized)	2062039004 (Polarized)	2062012005
⚠ 8	Cord Bush	4450056008	4450056008	4450060007
9	4P Terminal	2050050008	2050050008	2050050008
10	F-RCA Connector	2050313004	2050313004	ETC0827
13	Tuner Unit	ETC0827B	ETC0827B	ETC0827
14	Inner Panel Assy	1460811223	1460811223	1460811207
⚠ 50	Resistor (2.2 Mohm)	2420073000	—	—
51	Wood Board (R)	1011627109	1011627109	1011627109
52	Wood Board (L)	1011628108	1011628108	1011628108
53	Indication Sheet	5130784000	5130784000	5130784000
54	LA Approval Mark	5138300004	—	—
⚠ 55	Power SW	2123336002	2123336002	2124598001
⚠ 56	Capacitor C801	2530010007	2530010007	—
57				
58				
59				
60				
61				
62				
63				
64				
65				
66				
67				
68				
107	Screw	4734460035 (4x20)	4734460035 (4x20)	4734460035 (4x20)
203	Carton Case	5011099005	5011099005	501
205	Inst. Manual	5111415000	5111415000	5111414001
210	Protector Sheet	5049101004(2)	5049101004	5049101004
211	Warranty in Envelope	5150349108	5150388004	—

EXPLODED VIEW OF CHASSIS AND CABINET PARTS LIST FOR E2 BLACK VERSION

Note: 1. See addendum list right side for the parts with asterisk (*) on the Ref. No. and the other parts not included in the list.
2. * marked not included EXPLODED VIEW OF CHASSIS AND CABINET.
3. This list is prepared based on E2 for Black Version.

Ref. No.	Part No.	Part Name & Descriptions	Q'ty
1	4110559007	Main Chassis	1
2	4121979003	P.C.B. Holder	5
3	1040043000	Foot	4
⚠ 4	2335526105	Power Trans	1
* 5	4450033005	Wire Clamp Band	2
* 6	1050668009	Back Panel	1
* 7	2062039004	AC Cord	1
* 8	4450056008	Cord Bush	1
9	2050165003	2P Terminal	1
10	2050215005	Ant. Terminal	1
11	1460494006	Antenna Holder	1
12	2048016012	2P Connector Base	1
13	ETC0827	Tuner Unit	1s
** 14	1460811207	Inner Panel Assy	1
15	1410283105	Display Sheet	1
16	1430452007	Window	1
17	1430438005	Filter	1
** 18	1460804104	ESC. Bar	1
19	4121978101	Fixing Bracket	3
** 20	1441452203	Front Panel	1
21	1140066007	Flexible Ring	1
** 22	1130770209	Push Knob (P) Ass'y	1
** 23	1020122238	Top Cover	1
24	2311060009	Loop Antenna	1
25	4610223079	Rubber Sheet	2
26	5131144005	Blind Sheet	1
27			

Ref. No.	Part No.	Part Name & Description	Q'ty
SCREWS, NUTS			
101	SC-06272	Fix. Screw	4
102	4770064107	Fixing Screw	17
103	—	—	—
104	4737002005	Tapping Screw (P)3x6	2
105	4737009008	Tapping Screw (P)3x6	1
106	—	—	—
**107	4734454038	Truss Screw (2)4x8 (Black)	4
108	4737500044	Tapping Screw (P)3x8 (Black)	8
109	2050003107	3T Lug	1
110	—	—	—
PACKING & ACCESSORIES (not including EXPLODED VIEW)			
201	5040090004	Cabinet Cover	1
202	5030313306	Cushion	2
**203	5011076154	Carton Case	1
204	5050061007	Envelope	1
*205	5111414001	Inst. Manual	1
206	5290040008	FM Ant. Adaptor	1
207	2032101001	2P Connector Cord	1
208	5131167008	Control Card	1
**209	5139111014	Color Label (Black)	1

E2 Gold Version PARTS LIST

(Same as E2 BLACK VERSION (Left P/List) except the followings.)

Ref. No.	Part No.	Part Name & Descriptions	Q'ty
14	1460811210	Inner Panel Assy	1
18	1460804120	ESC. Bar	1
20	1441452216	Front Panel	1
22	1130770212	Push Knob (P) Ass'y	1
23	1020122200	Top Cover	1
107	4734801005	Truss Screw 4x8	4
203	5011076187	Carton Case	1
209	5139111001	Color Label (Gold)	1

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TLX: JAPANOLA J22591
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Printed in Japan 603 NE 0029