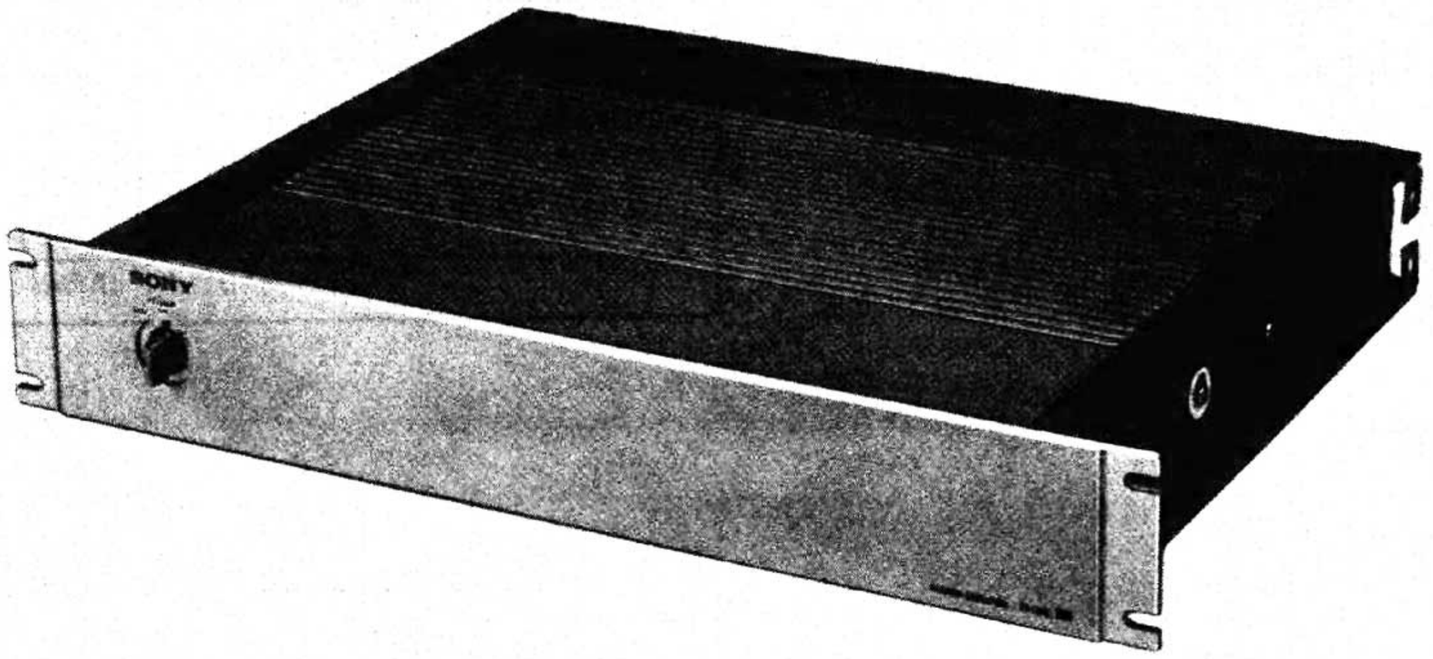
TA-N88

US Model
AEP Model



STEREO POWER AMPLIFIER

SPECIFICATIONS

GENERAL

Power Requirements: 90 – 130V ac, 50 – 400Hz (US model)
220 – 240V ac, 50 – 400Hz (AEP model)
110 – 140V dc (US model)
240 – 300V dc (AEP model)

Power Consumption: 135W (US model)
550W (AEP model)

Dimensions: Approx. 480 (w) x 80 (h) x 360 (d) mm
18 7/8 (w) x 3 1/8 (h) x 14 1/4 (d) inches
Including projecting parts and controls

Weight: Approx. 11kg, 23 lb 6oz (net)
13kg, 28 lb 4oz (with shipping carton)

POWER AMPLIFIER SECTION

Continuous RMS Power Output (rated output) (Less than 0.5% total harmonic distortion): Both channels driven simultaneously
At 20 – 20,000Hz
160 + 160W (8Ω)
According to DIN45500
160 + 160W (8Ω)

Damping Factor: 20 (8Ω, 1000Hz)

Harmonic Distortion: Less than 0.5% at rated output

IM Distortion (60Hz : 7kHz = 4 : 1): Less than 0.1% at rated output

Frequency Response: 5 – 40,000Hz $^{+0.5}_{-1}$ dB

S/N Ratio: Greater than 110dB, short-circuited input

Residual Noise: Less than 100μV (8Ω, weighting network A)

Inputs: INPUT
Sensitivity 1.4V (for rated output)
Impedance 50kΩ

Outputs: SPEAKER
Accept speakers of 8 – 16Ω

SAFETY-RELATED COMPONENT WARNING!!

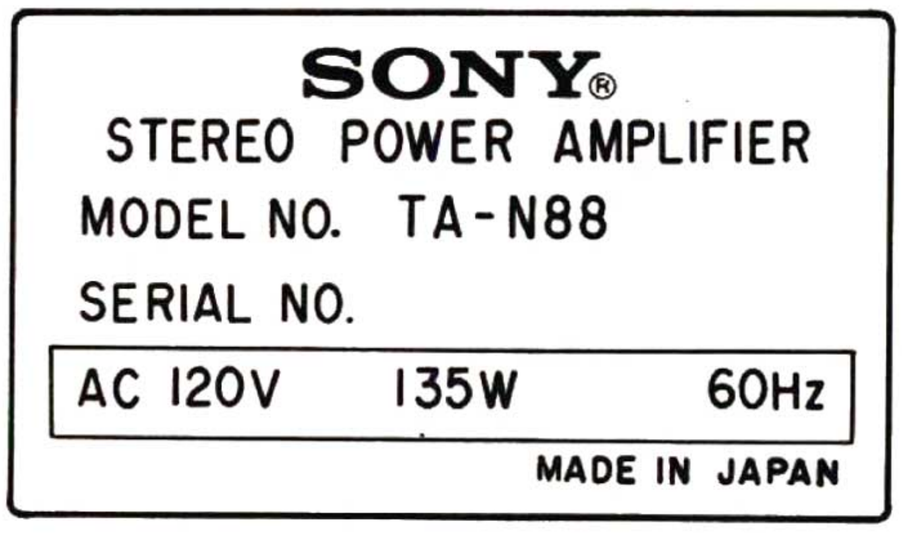
COMPONENTS IDENTIFIED BY SHADING AND ⚠ MARK ON THE SCHEMATIC DIAGRAMS, EXPLODED VIEWS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY.

SONY®
SERVICE MANUAL

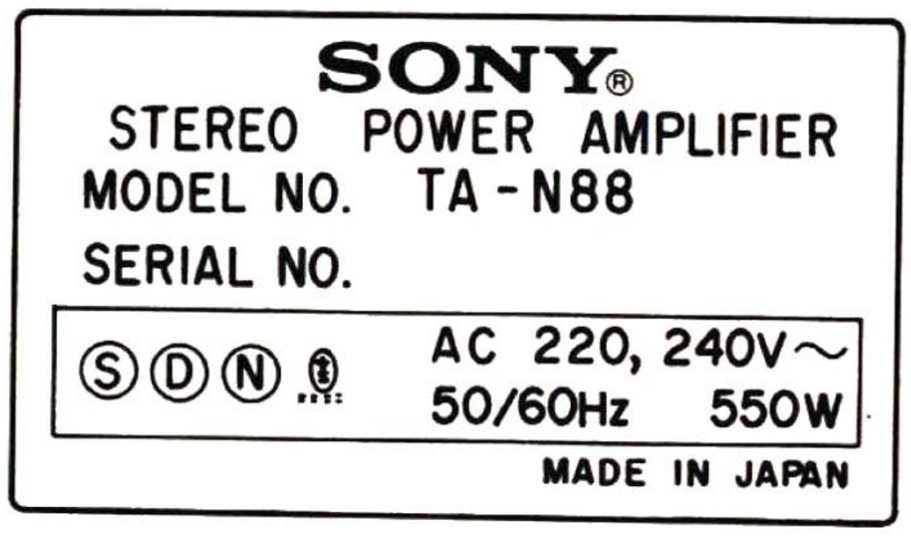
MODEL IDENTIFICATION

— Specification Label —

US model



AEP model



SECTION 1
OUTLINE

1-1. SERVICING NOTE

1. This set is utilizing pulse circuitry. Use an oscilloscope having a bandwidth of wider than 10MHz.
2. Be sure to discharge current completely before starting repair. This set uses V-FETs. Also this set utilizes 140-V voltage in the power supply and ±120-V voltage in the amplifier section. Accordingly, not only V-FETs but also many other components may easily be damaged if any component lead wires or pattern foils are inadvertently shorted out by a screwdriver or a soldering iron due to the redidual charge in the power-supply capacitors even when the power is turned off.

To prevent the damage of these components, be sure to discharge electrolytic capacitors, after turning the power off, in the power supply as shown in Fig. 1 every time the check or repair is required.

Note: All resistors are about 10 ohms.

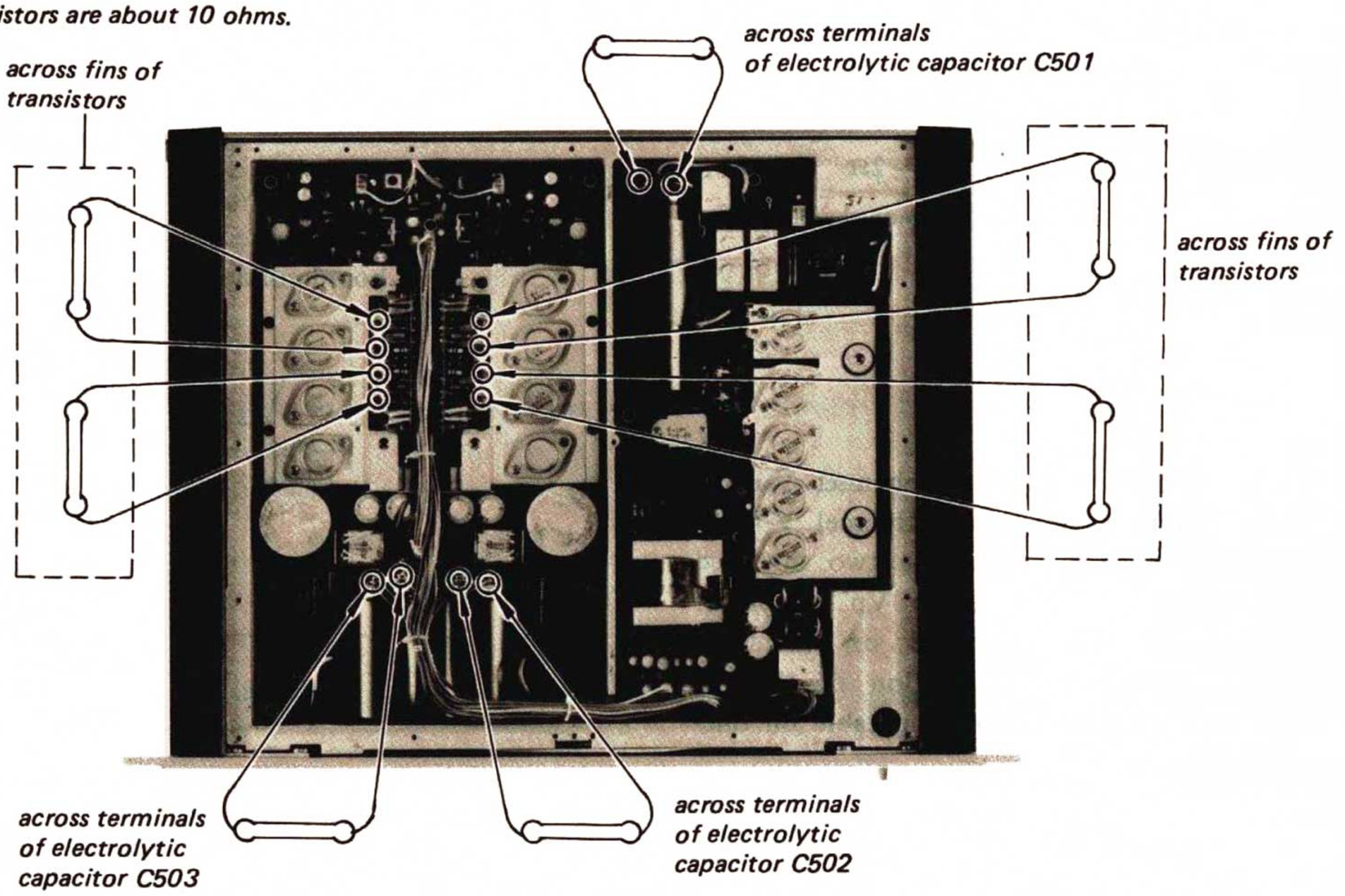
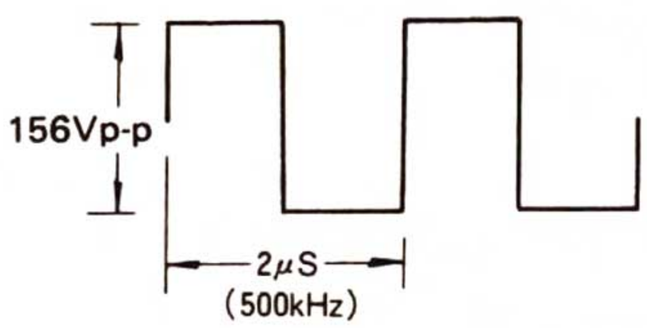


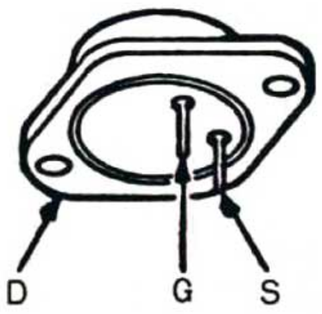
Fig. 1

3. Power Supply Checking
   a) ±78-V voltages should present on C502 and C503. Voltage adjustment can be made by RT401.
   b) If voltages on C502 and C503 cannot be adjusted by RT401 and higher voltages of about ±100V are present, check the switching transistor Q401 in the power supply.
   c) If voltages do not present on C502 and C503, check Q409 through Q412 of the inverter circuit in the power supply.
4. Power Amp Checking
   a) Check waveform at the drains of V-FETs of each channel. The following waveform should be obtained.



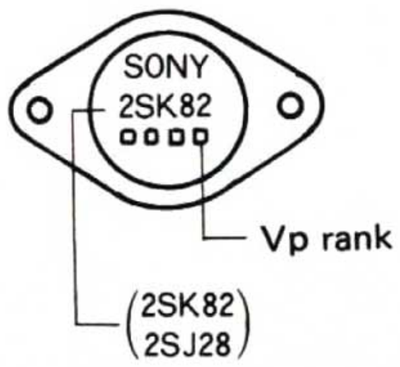
b) If either of the L- or R-channels is out of order, the relay RY101 or RY151 of the associated channel opens. In this condition, no sound outputs come out from both channel's SPEAKER terminals.

5. Replacing V-FETs
   a) Completely discharge the power supply electrolytic capacitors as outlined in 2 above.
   b) Remove V-FET by removing screws.
   c) Check resistance readings of each two electrodes of V-FET using a VOM as follows.



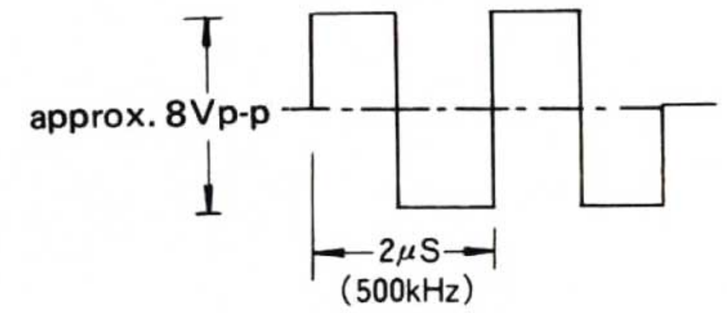
VOM range: x 1Ω
GOOD FETs show the following.
S-D : 1 – 2Ω
S-G, D-G : diode characteristic

When replacing the two P-channel V-FETs 2SK82 and/or the two N-channel V-FETs 2SJ28 in each channel, use two matched ones which have the same Vp (pinch-off voltage)-rank figure printed on them as shown below. The fluctuation of the Vp rank of the two can be acceptable on one-rank-difference basis.

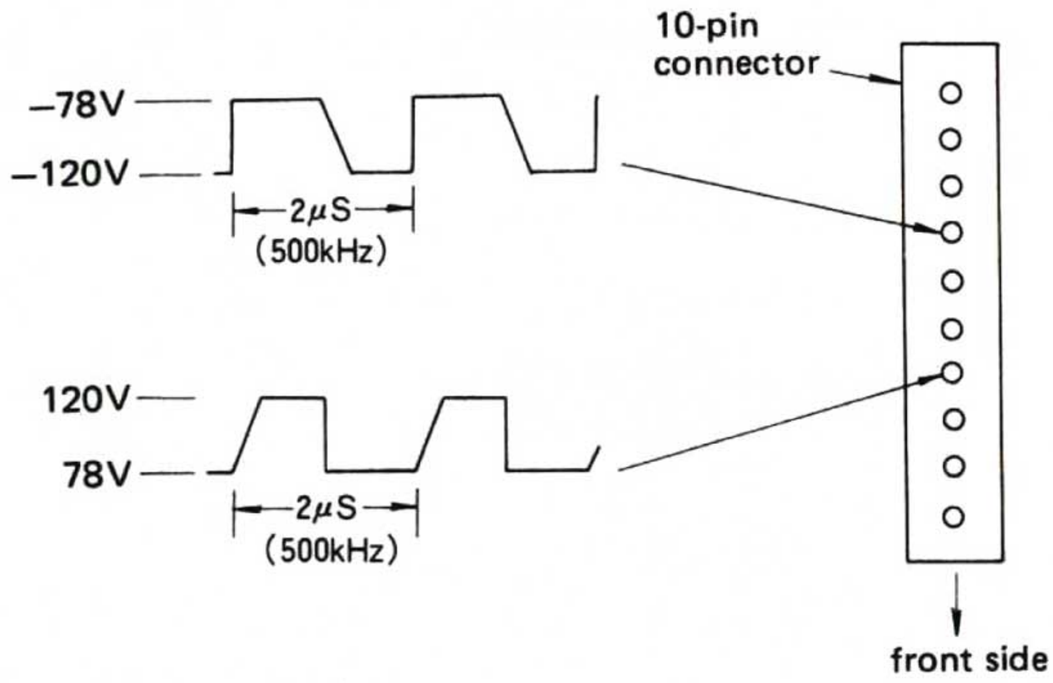


Do not install the new V-FETs yet until instructed to do so later.

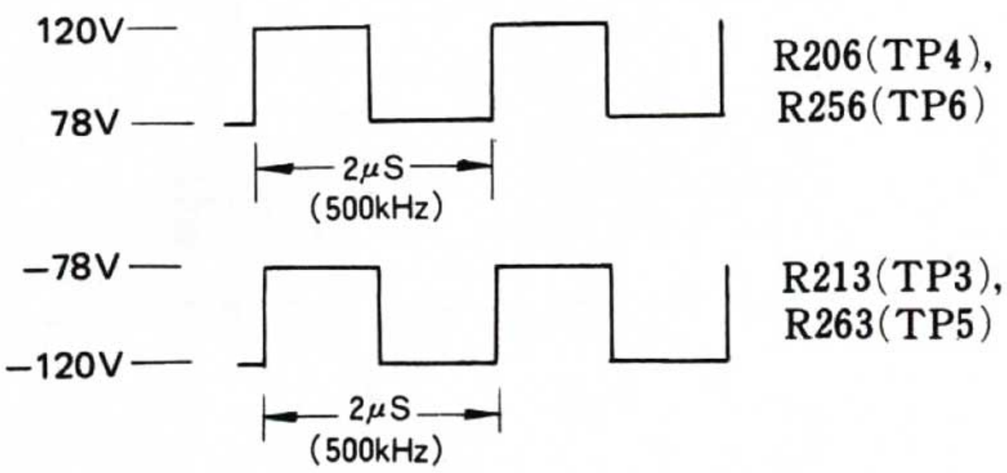
d) Remove the power-drive board of the associated channel by removing two screws. Check the fusible resistors on the power-drive board. Replace those defective fusible resistors.
e) Remove the power-amp board of the associated channel by removing ten screws. Replace the tantalum capacitor C104 220/6.3V (L-CH) or C154 220/6.3V (R-CH).
f) Reattach the power amp board on the chassis.
g) Temporarily make a solder connection to the lead of R119 100kΩ (L-CH) or R169 100kΩ (R-CH) for a checking purposes.
h) Now the set has the power-drive board and V-FETs removed aside.
   Turn POWER ON.
i) Check the waveform at TP1 (L-CH) and TP2 (R-CH) for that shown below.
   Adjust RT101 (L-CH) or RT151 (R-CH) to make the levels of the positive and negative halves equal.
   Adjust T301 to obtain the specified pulse width.



j) Check waveforms at pins 4 and 7 of the 10-pin connector to which the power-drive board connects.



k) Turn POWER OFF.
l) Install the power-drive board and V-FETs in place. Do not fasten V-FETs with screws yet, i.e., the drains are in the open-circuit condition.
m) Turn POWER ON.
n) Check waveforms at TP3, TP4 (L-CH) and TP5, TP6 (R-CH) as shown below.



o) Turn POWER OFF and completely discharge electrolytic capacitors as outlined above.
p) Fasten V-FETs with screws. Now the drains of V-FETs are electrically connected.
q) Remove the solder joint made to R119 or R169 in step g).

1-2. CIRCUIT DESCRIPTION

1-2-1. Amplifier Section

a) High-Speed Input Attenuator
This attenuator is composed of FETs. This attenuator protects the amplifer by attenuating the input signal at a response speed of faster than 1μsec when SPEAKER terminals are errorneously shorted out or when an overloading input signal is applied, in both cases the current drain in the power-amplifier output stage V-FETs excesse the rated value.

b) Carrior Oscillator
This oscillator is of the Colpits configuration, and generates a 500kHz signal.
This 500kHz signal is applied to the P-channel dual-transistor differential amplifier and this amplifier makes an even-duty square wave. This square-wave signal is then applied to the emitter followers for both the L and R channels. Thus the carrior signal is applied to the integrating circuit.

c) Integrating Circuit
To the input of the mirror integrating circuit, audio and 500kHz carrior signals are applied. In this integrator, a highly-accurate integration is made by subtracting the input and carrier signal component from the output signal.
Accordingly, this circuit has a very-wide bandwidth of dc – several MHz to transfer the audio and carrior signals. The first-stage of this integrator is composed of a dual FET which is connected to a current source. The second stage is composed of PNP-type transistors which has also a current source connected to it.

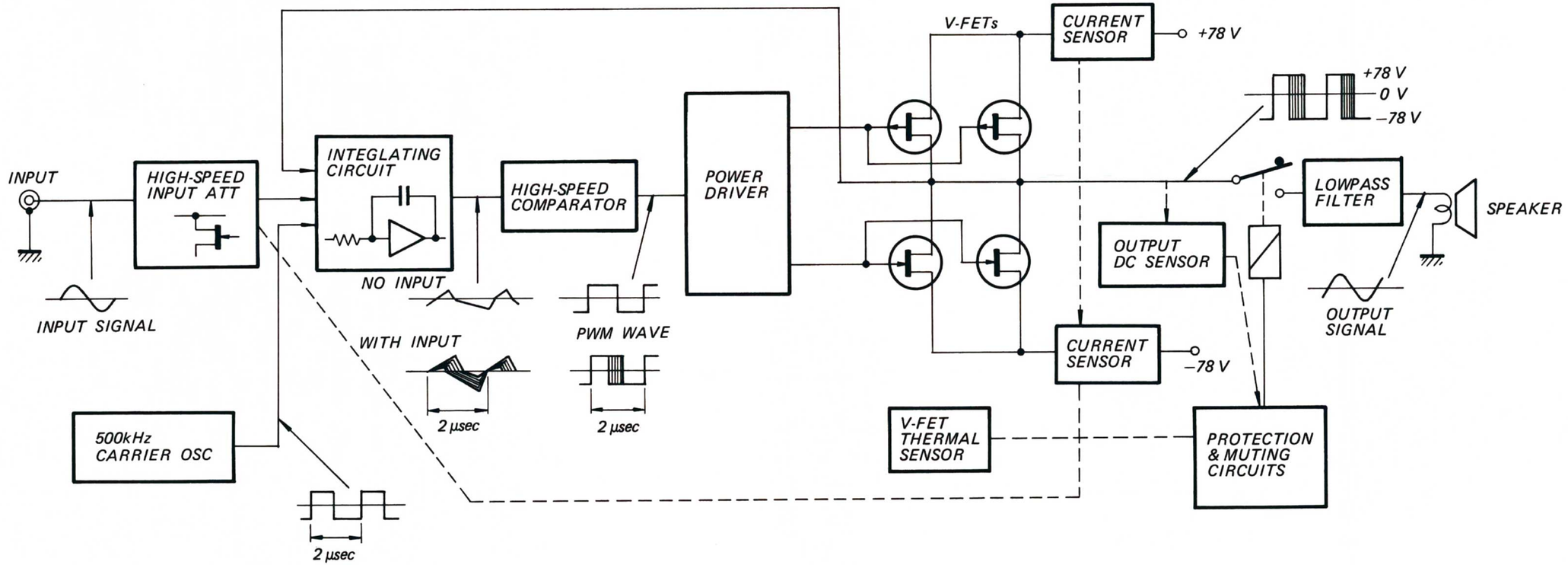
d) High-speed Comparator
An IC is used for the comparator to fit the very-high-speed response characteristics. This IC is composed of three differential amplifiers connected in series. This comparator functions with the input-level difference of less than 1mV, and the square-wave PWM output signal is obtained with the speed of less than 20nsec.

e) Power Driver
This circuit is to drive the final V-FETs for voltage amplification. This driver receives the PWM output signal of about 8Vp-p and amplifies it to 40Vp-p which is required to drive the gates of V-FETs in the power amplifier.
Transistors with a high f_T are used in a switching manner to maintain an ample driving capability, because the gate of V-FET has a rather large capacitive input load.

f) V-FET Switching Circuit
The newly-developed and high-power switching-purpose V-FETs are used in the parallel pushpull configuration. These V-FETs enable high-power switching of up to 160V/10A at a response time of 50n sec.

g) Lowpass Filter
This filter is to draw the audio signal out of the pulse-width-modulated signal. This filter is composed of choke coils and capacitors and has a low insertion loss. The frequency response of this set is determined by this filter.
Generally, the frequency response fluctuates according to the change of the load impedance. This lowpass filter is designed to have a good frequency response and phase characteristics for general speakers of 8Ω nominal to maintain a good audio.

h) Protectors
This amplifier is equipped with 1) current sensor to protect V-FETs from damaging in case of short circuiting, large-current output operation or a over-the-rating operation; 2) thermal sensor to cut the speaker circuit off when the temperature of V-FET exceeds 90°C (194°F) under a high ambient temperature, a long and continuous operation or during measurement;
3) dc sensor to protect speakers in case of generation of dc component under dc input or an abnormal circuit operation.



1-2-2. Pulse-locked Power Supply

The power transfer capability of the core-type power transformers increase in proportion to the line frequency used. However, most of the conventional core-type power transformers are used under the line frequency of 50Hz or 60Hz, and they are big in size and heavy in weight.

By utilizing the pulse-locked power supply technique, it is quite possible to make very-small, light-weight and large-capacity power supplies using built-in 20kHz generator.

a) Primary Rectifying Circuit
In ac operation, ac input of 90 to 130V or 220 to 240V is bridge-rectified and the output of 130 to 168V dc is obtained.
In dc operation, dc input of 110 to 140V or 240 to 300V is directly used regardless of the input polarities.

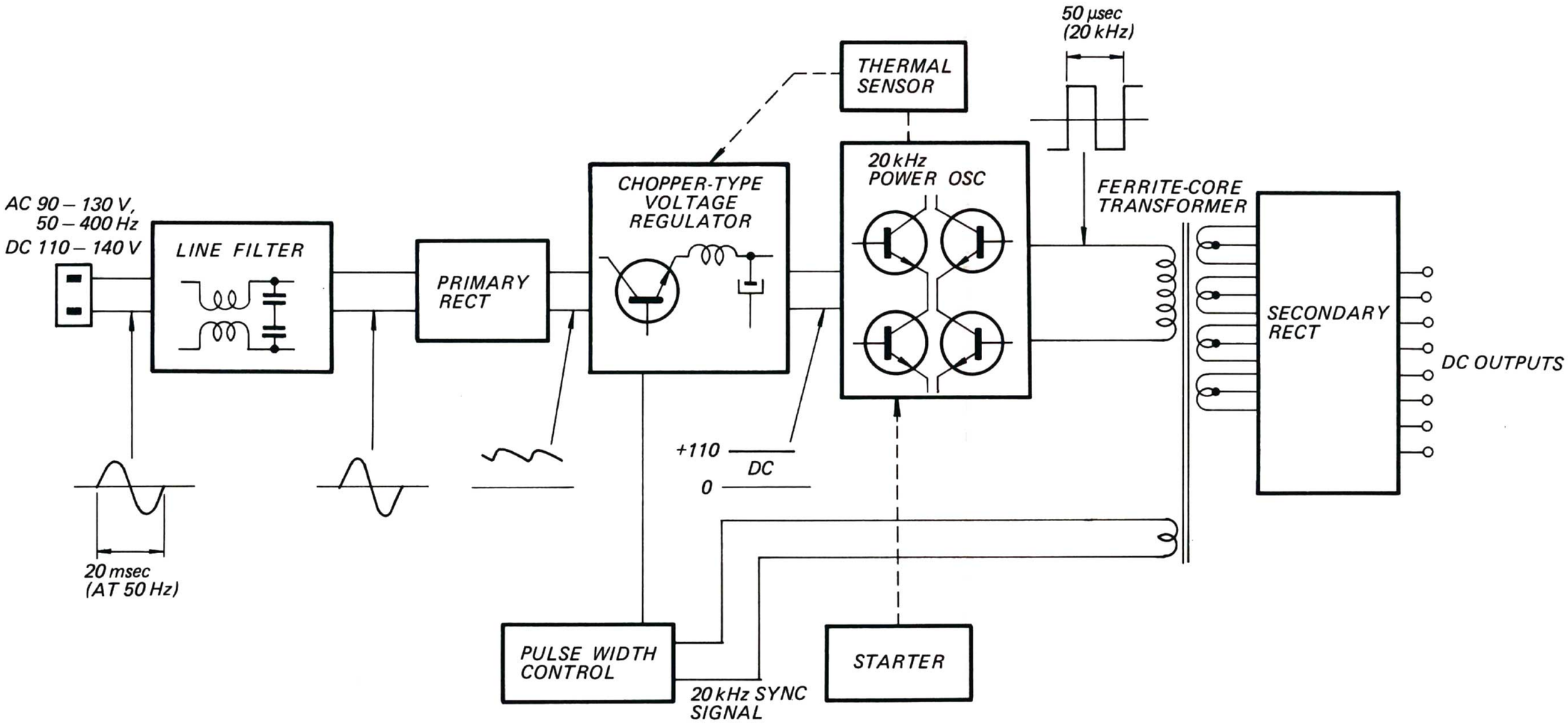
b) Chopper-type Voltage Regulator
The 20kHz control pulse drives the switching transistors and a constant output voltage of 110Vp-p is obtained.

c) Pulse-width Control Circuit
This circuit utilizes the square wave generated in the 20kHz power oscillator to make a triangle wave. The level of the triangle wave is compared with the internal reference voltage and a control pulse is made to maintain the output voltage of the chopper-type voltage regulator constant.

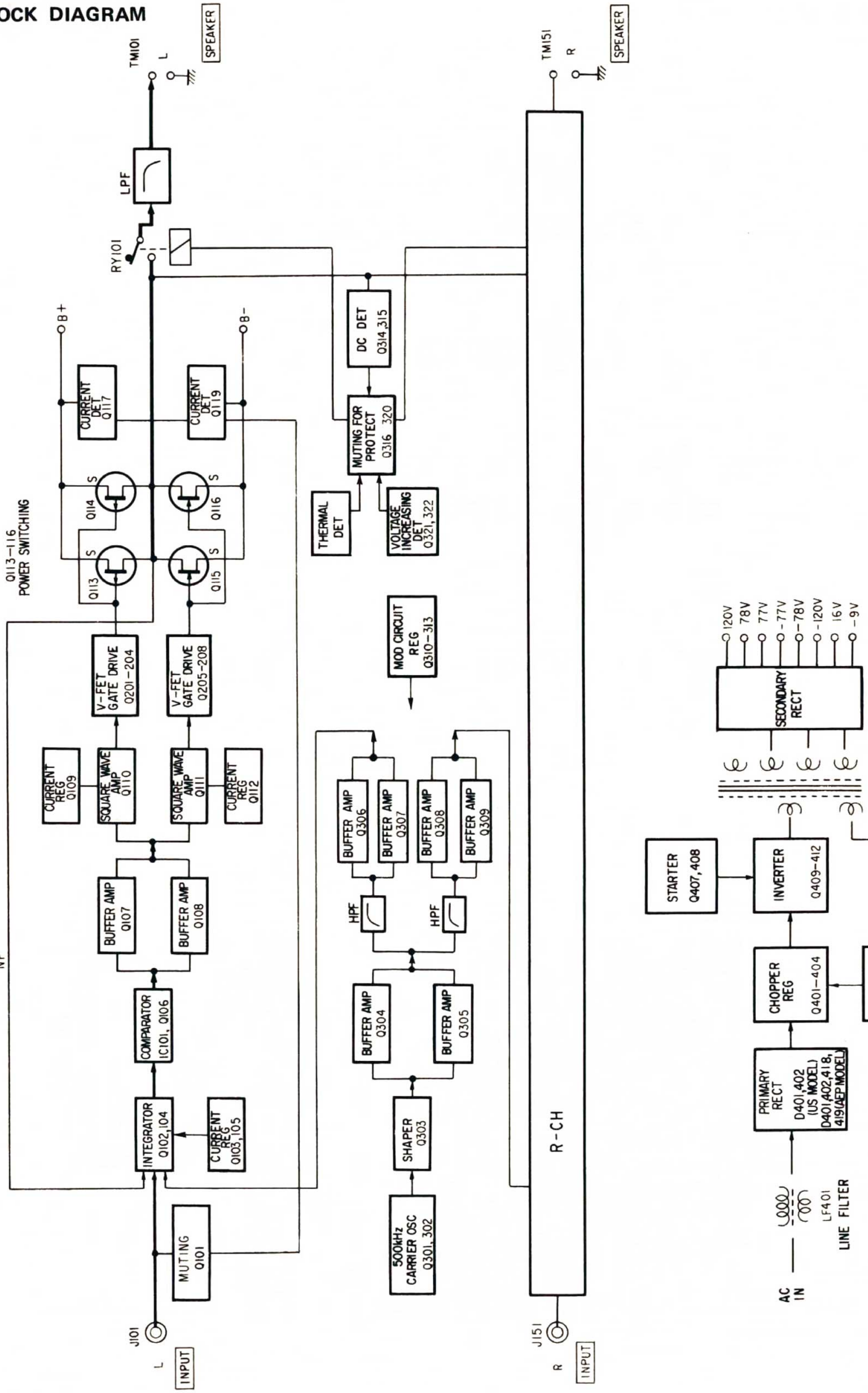
d) 20kHz Power Oscillator
This circuit generates a stable and high-power 20kHz pulse by using four high-power switching transistors in the full-bridge self-oscillating circuit configuration.

e) Ferrite-core Transformer
The ferrite-core transformer transfers the 20kHz pulse signal and this serves the functions of the conventional power transformer. This transformer features a low-loss, high-permeability and a high-saturation magnetic-flux density operation at the high frequency of 20kHz.
This transformer also has a doubled electrostatic shield in itself to reduce the radiation of the switching noise to a minimum possible value.
This transformer has a power-transfer capability of sixty times that of the conventional power transformers for 50Hz- or 60Hz-line use, and also has a superior voltage regulation between the primary and secondary windings by shortening the total length of wire of the windings.

f) Secondary Rectifying Circuit
This circuit provides several kinds of dc voltages needed for the respective stages of the power amplifier. These voltage are well regulated and very stable.



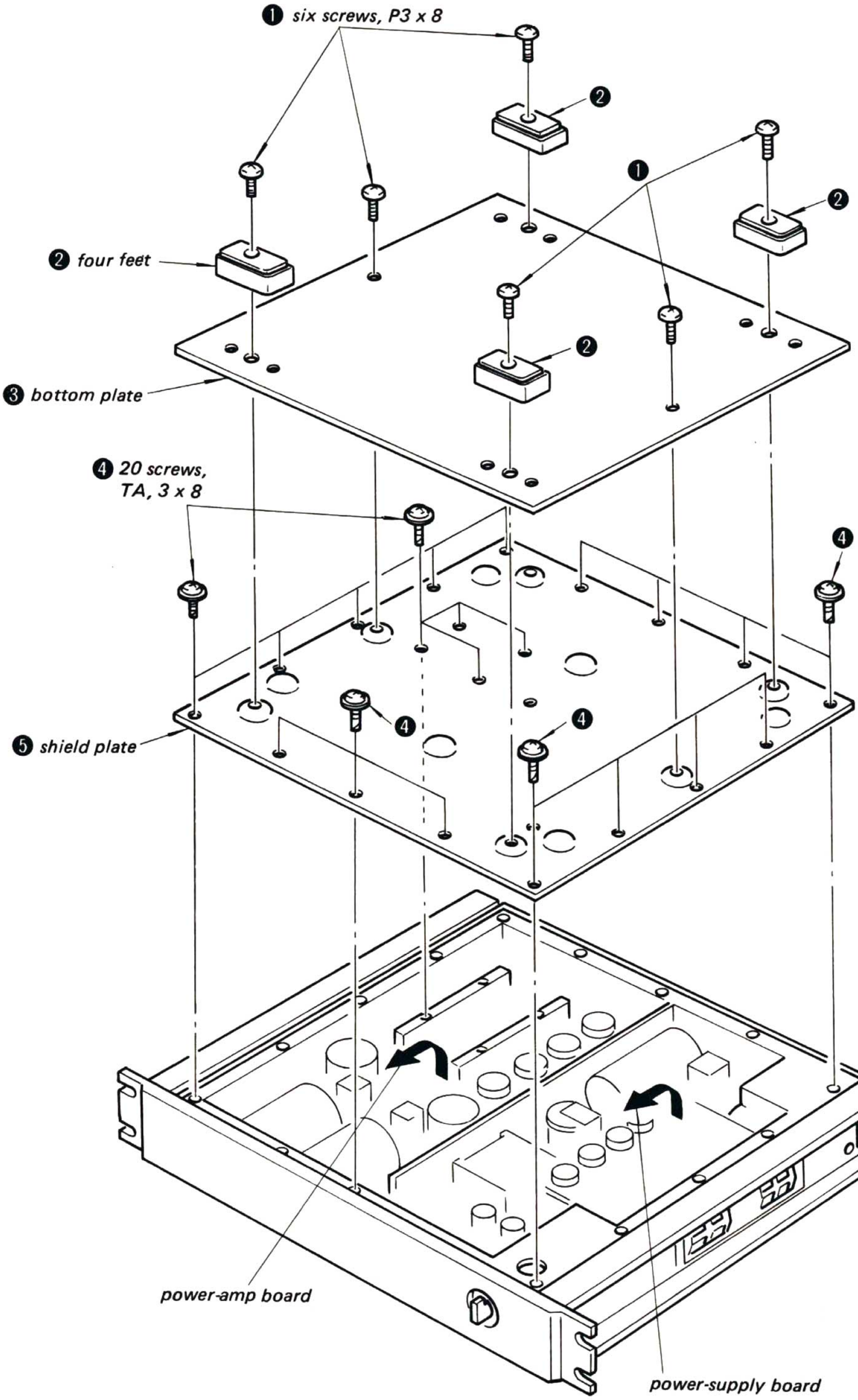
1-3. BLOCK DIAGRAM



SECTION 2
DISASSEMBLY

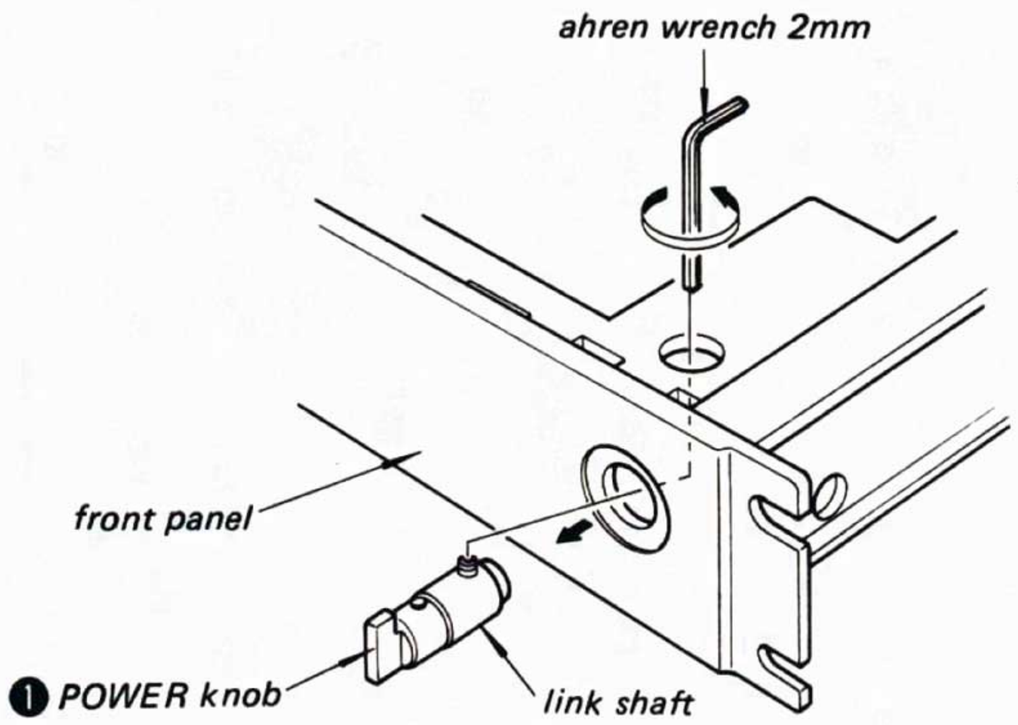
Note: Remove in the numerical order.

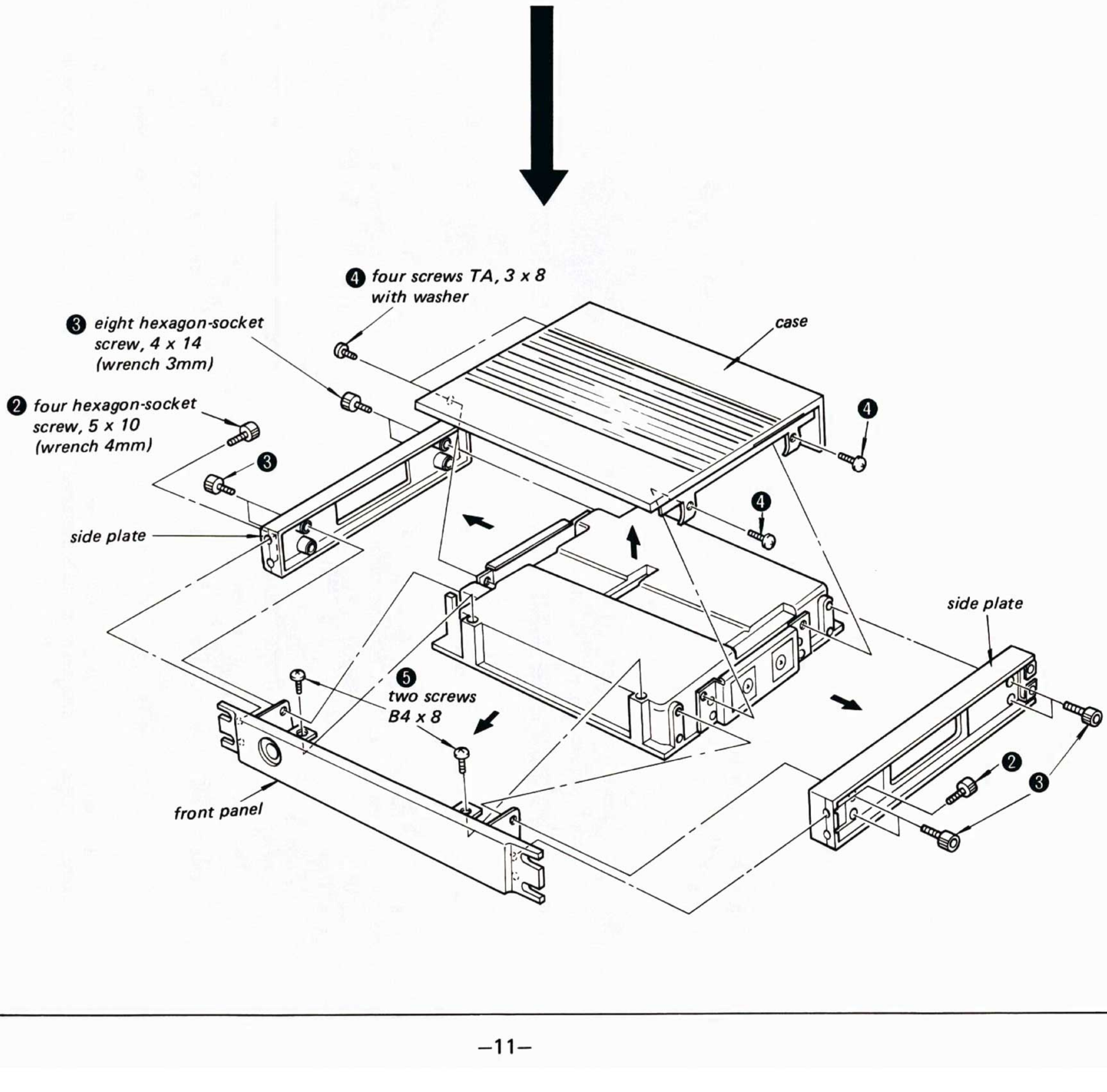
BOTTOM AND SHIELD PLATE REMOVAL



Note: Under this condition, component sides of circuit board can be checked.
To check foil side(s), remove screws which fasten circuit board(s) and turn the board(s) in the direction shown by the arrow(s).

PANEL REMOVAL

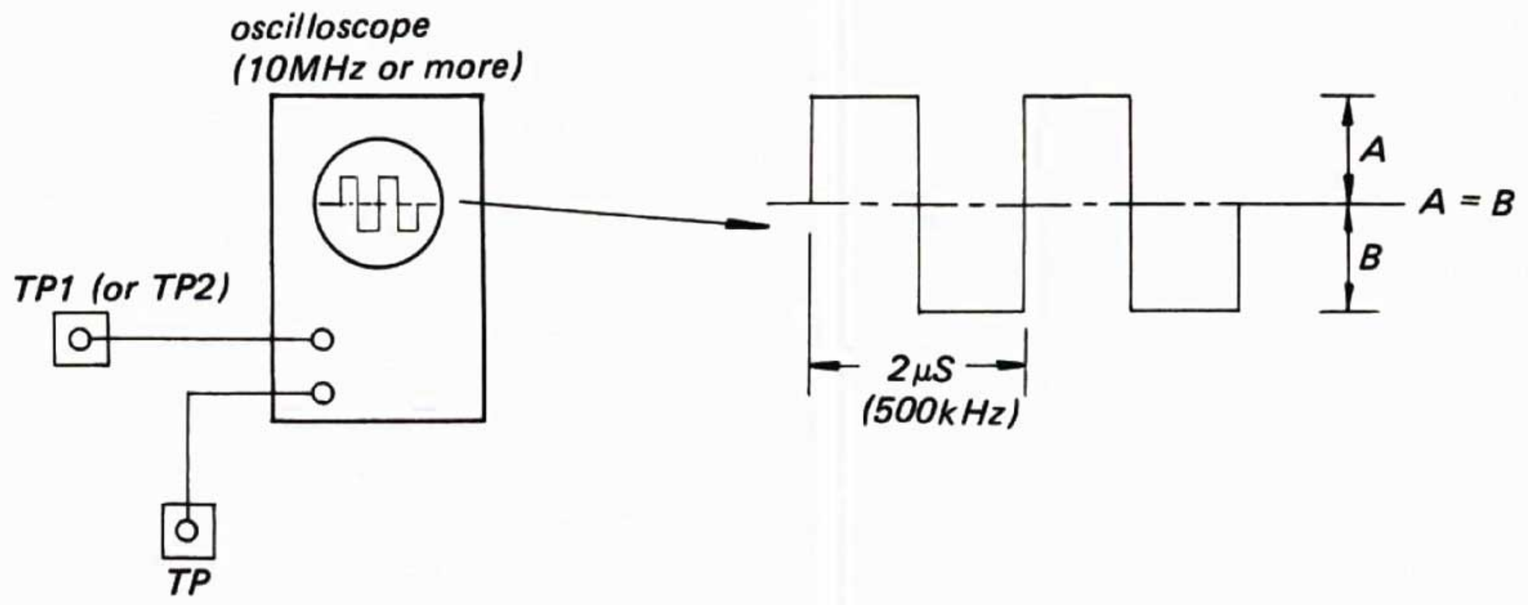




SECTION 3
ADJUSTMENTS

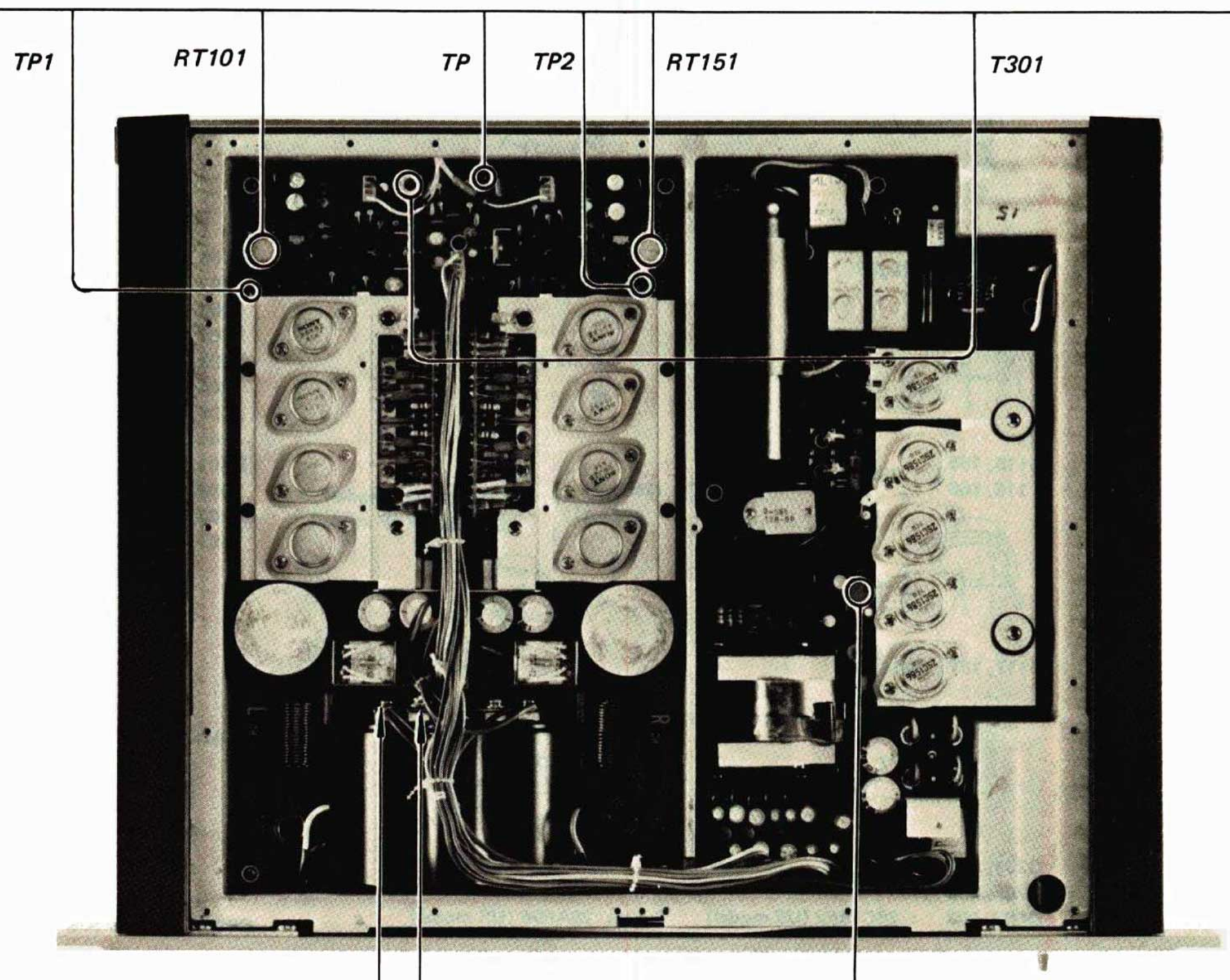
PULSE LEVEL ADJUSTMENT

Adjust RT101 (L-CH) and RT151 (R-CH) to make the positive and negative halves of the square wave at TP1 (L-CH) and TP2 (R-CH) equal.

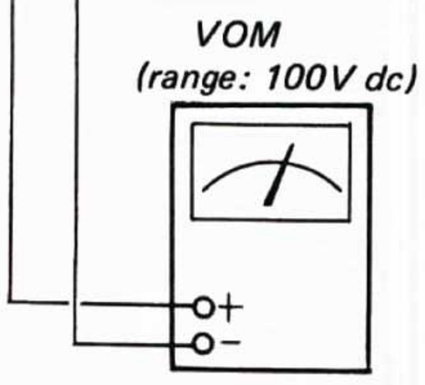


OSCILLATION FREQUENCY ADJUSTMENT

Adjust T301 so that the pulse width of the pulse at TP1 (L-CH) or TP2 (R-CH) becomes 2μsec (500kHz).



VOLTAGE ADJUSTMENT



Adjust RT401 for a 78V reading on the VOM.

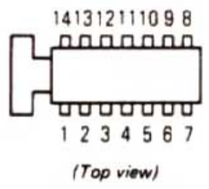
SECTION 4
DIAGRAMS

4-1. MOUNTING DIAGRAMS

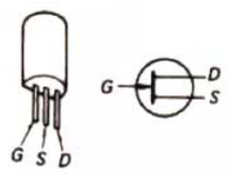
Replacement Semiconductors

For replacement, use semiconductors except in ( ).

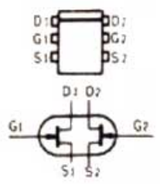
IC101, 151: CX034



Q101, 151: 2SK43-5 (2SK43-6)



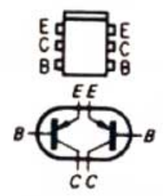
Q102, 152: 2SK58



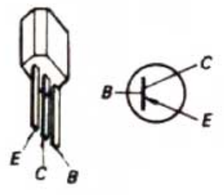
Q103, 153, 105, 155, 107, 157, 301, 304, 306, 308, 314–316, 321, 322, 408 : 2SC634A

119, 169 : 2SC926A

Q106, 156, 302, 406 : 2SA884

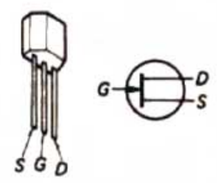


Q104, 154, 108, 158, 305, 307, 309, 317–320, 407 : 2SA678

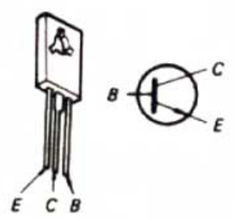


Q109, 159, 112, 162 : 2SK23A-940

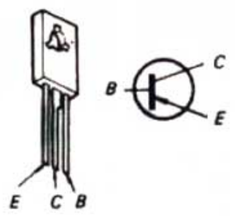
310, 311 : 2SK23A-840 (blue)



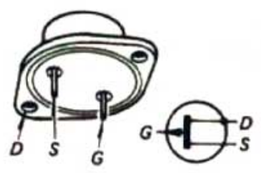
Q110, 160: 2SC1904



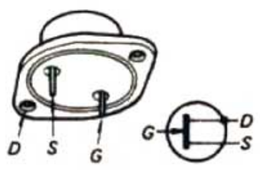
Q111, 161: 2SA899



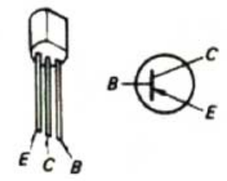
Q113, 163, 114, 164 : 2SJ28



Q115, 165, 116, 166 : 2SK82

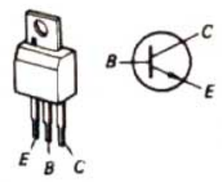


Q117, 167: 2SA639S



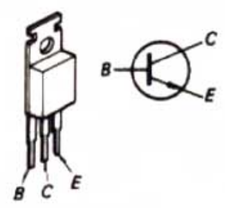
Q201, 251, 205, 255 : 2SC1124

Q402, 403 : 2SC1962 (US model)

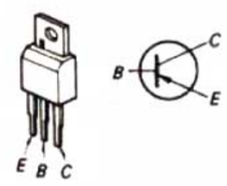


Q202, 252, 206, 256 : 2SC1173 (yellow)

Q313 : 2SC1061

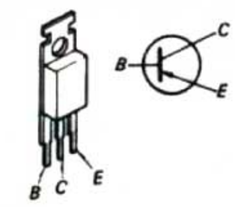


Q203, 253, 207, 257 : 2SA706

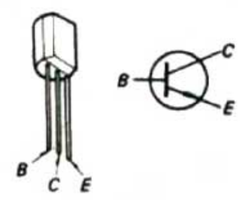


Q204, 254, 208, 258 : 2SA473 (yellow)

Q312 : 2SA671

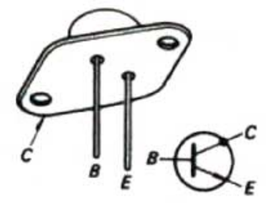


Q303: 2SC710

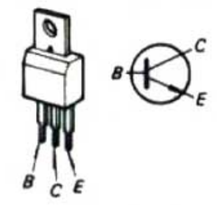


Q401, 409–412 : 2SC1586 (US model)

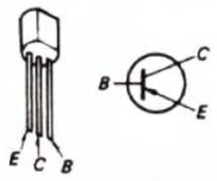
2SC2190 (AEP model)



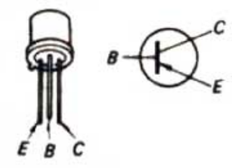
Q402, 403, 405: 2SC1810 (AEP model)



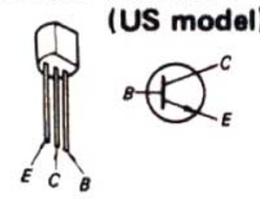
Q404: 2SA896 (US model)



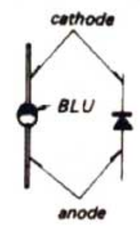
2SA911 (AEP model)



Q405: 2SC1811 (US model)

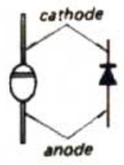


D101, 151: MV12N



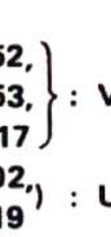
D102, 152, 103, 153, 412–417 : V09C

D401, 402, 418, 419 : U05G (AEP model)

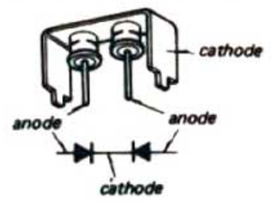


D106, 156, 107, 157, 201, 251, 202, 252 : 1S1587

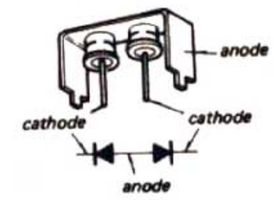
D203, 253 204, 254, 205, 255, 206, 256, D301, 302, 306, 307, D403, 406, 407 : 1S1555



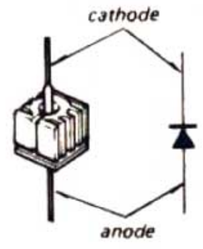
D401: S5151 (US model)



D402: S5151R (US model)



D404, 420: UF3



– Power Supply Input Section (AEP model) –

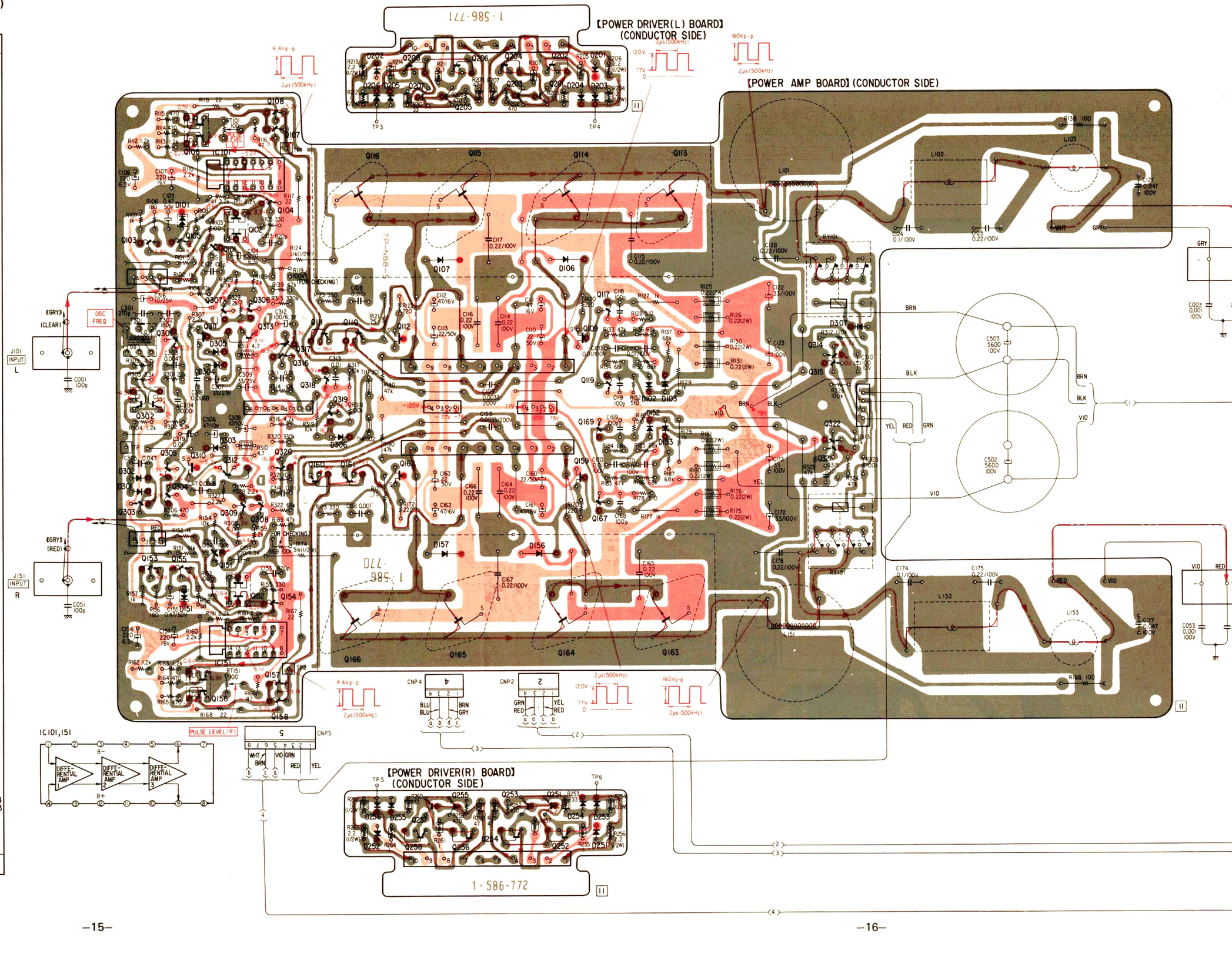
– Conductor Side –

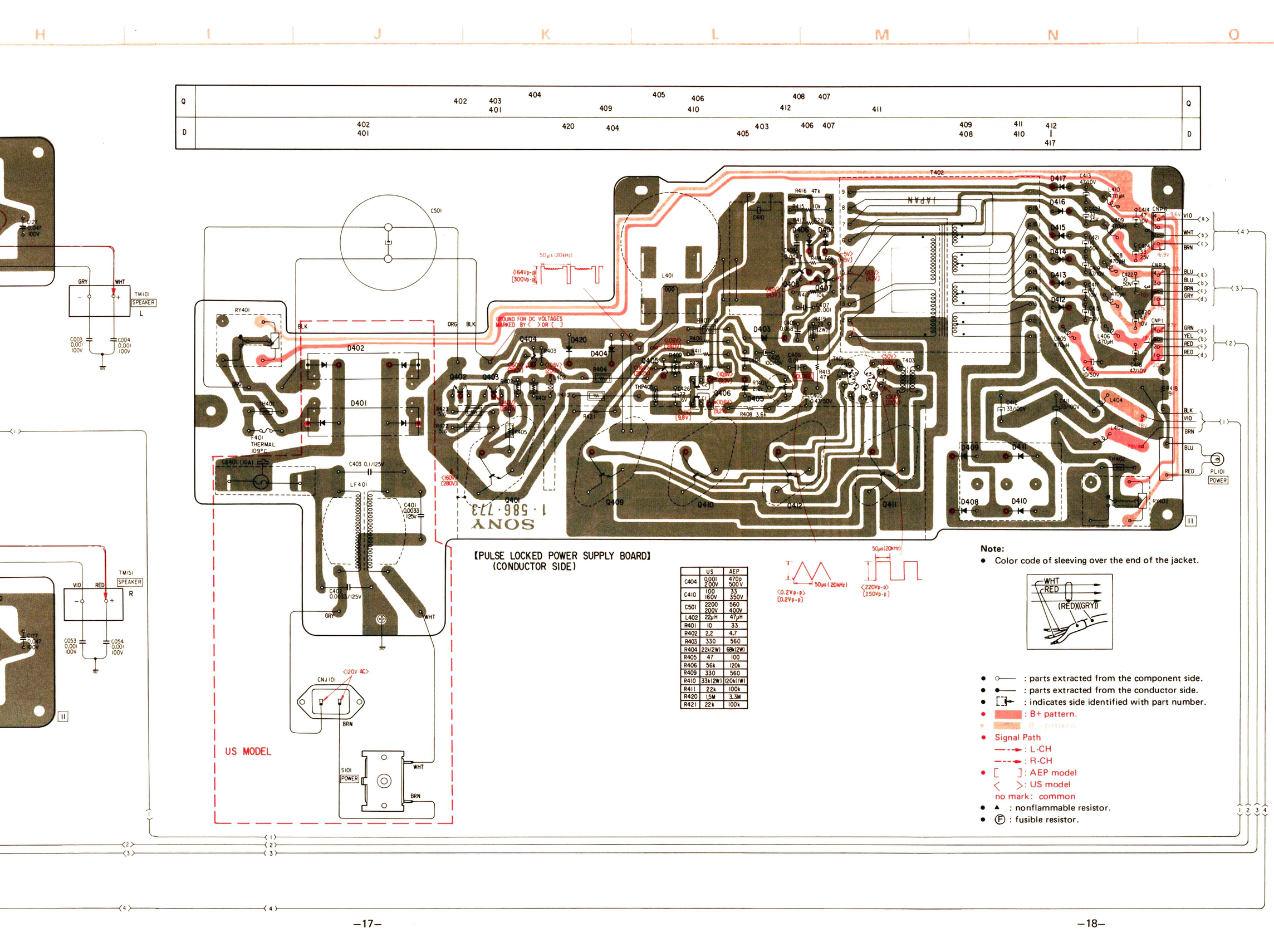
– Component Side –

4-2. MOUNTING DIAGRAM (2)

– Conductor Side –

Q, IC	D
208, 204 206, 202	202, 201
207, 203 205, 201	206, 204 205, 203
108	
106 107	
IC101	
116 115 104 114 113	
102	101
103, 105 101	
	107, 106
307, 306 117	
301, 311 313 111 109 110 112 317	307 305
316 314	304
315 318 119	102, 103
302 319	
169	152, 153
322	306
321	303
305, 310 312, 320	
160, 161 159	302
304 162	301
303 167	
309, 308	
151	157, 156
153, 155	
152 154	151
166 165 164 163	
IC151	
156 157	
158	
257, 253 255, 251	256, 254 255, 253
258, 254 256, 252	252, 251
Q, IC	D





【PULSE LOCKED POWER SUPPLY BOARD】
(CONDUCTOR SIDE)

	US	AEP
C404	0.001 2.00V	470p 500V
C410	100 160V	33 350V
C501	2200 200V	560 400V
L402	22µH	47µH
R401	10	33
R402	2.2	4.7
R403	330	560
R404	22k(2W)	68k(2W)
R405	47	100
R406	56k	120k
R409	330	560
R410	33k(2W)	(20k(1W)
R411	22k	100k
R420	1.5M	3.3M
R421	22k	100k

Note:

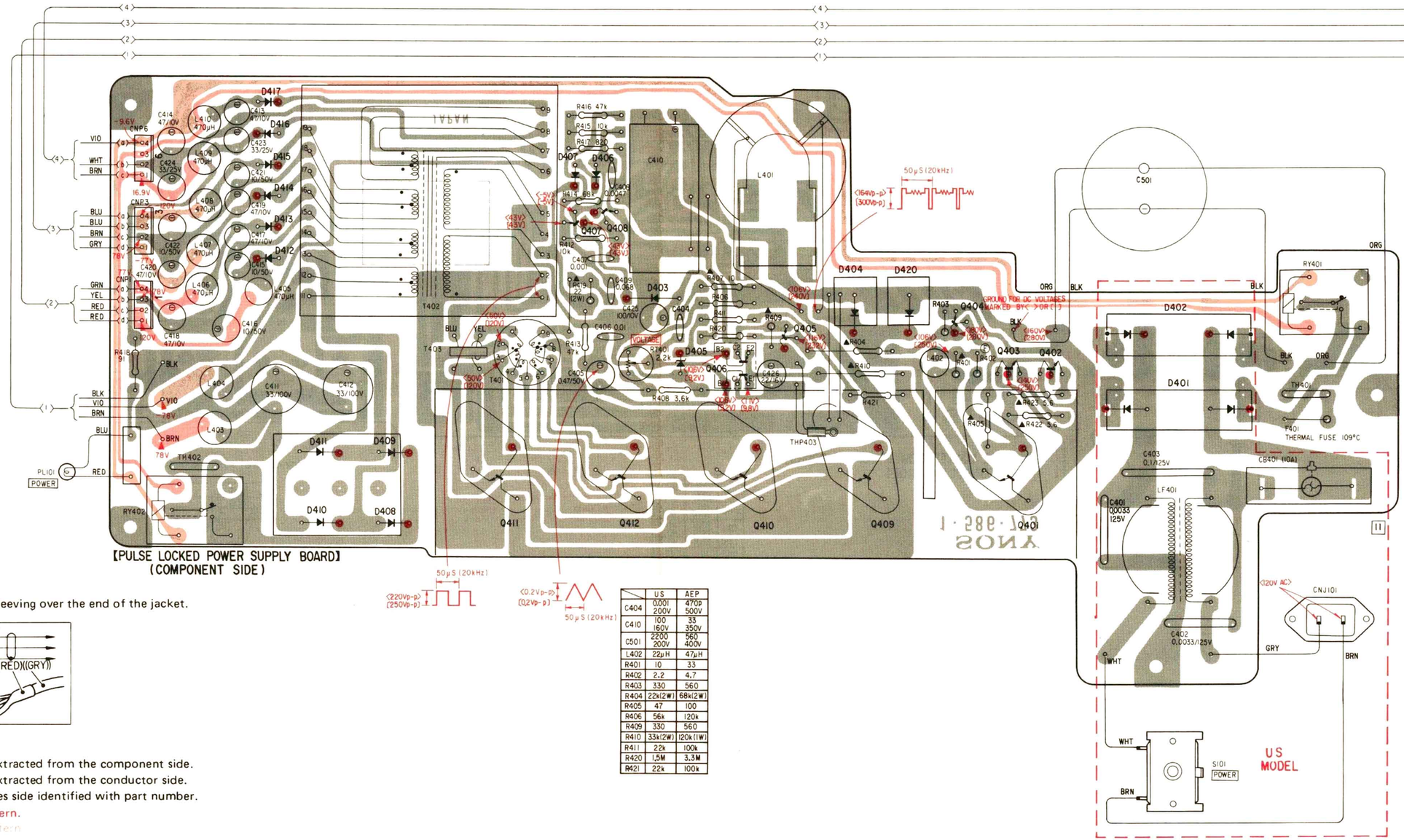
- Color code of sleeving over the end of the jacket.

- ○— : parts extracted from the component side.
- ●— : parts extracted from the conductor side.
- [-]— : indicates side identified with part number.
- : B+ pattern.
- : B− pattern.
- Signal Path
  - —→ : L-CH
  - - - → : R-CH
- [ ] : AEP model
- < > : US model
  - no mark : common
- ▲ : nonflammable resistor.
- Ⓕ : fusible resistor.

4-2. MOUNTING DIAGRAM

– Conductor Side –

Q	411 · 407 408 · 412 · 406 410 · 405 · 409 · 404 · 403 401 · 402	Q
D	417,416,415,414,413,412 411 410 · 409 408 · 407 406 · 403 405 · 404 · 420 · 402 401	D



【PULSE LOCKED POWER SUPPLY BOARD】
(COMPONENT SIDE)

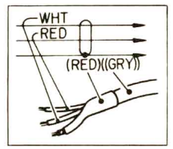
50µS (20kHz)
(220Vp-p) (250Vp-p)

(0.2Vp-p) (0.2Vp-p)
50µS (20kHz)

	US	AEP
C404	0.001 200V	470p 500V
C410	100 160V	33 350V
C501	2200 200V	560 400V
L402	22µH	47µH
R401	10	33
R402	2.2	4.7
R403	330	560
R404	22k(2W)	68k(2W)
R405	47	100
R406	56k	120k
R409	330	560
R410	33k(2W)	120k(1W)
R411	22k	100k
R420	1.5M	3.3M
R421	22k	100k

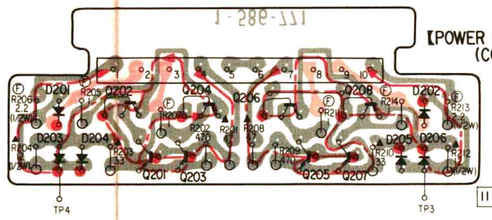
Note:

- Color code of sleeving over the end of the jacket.

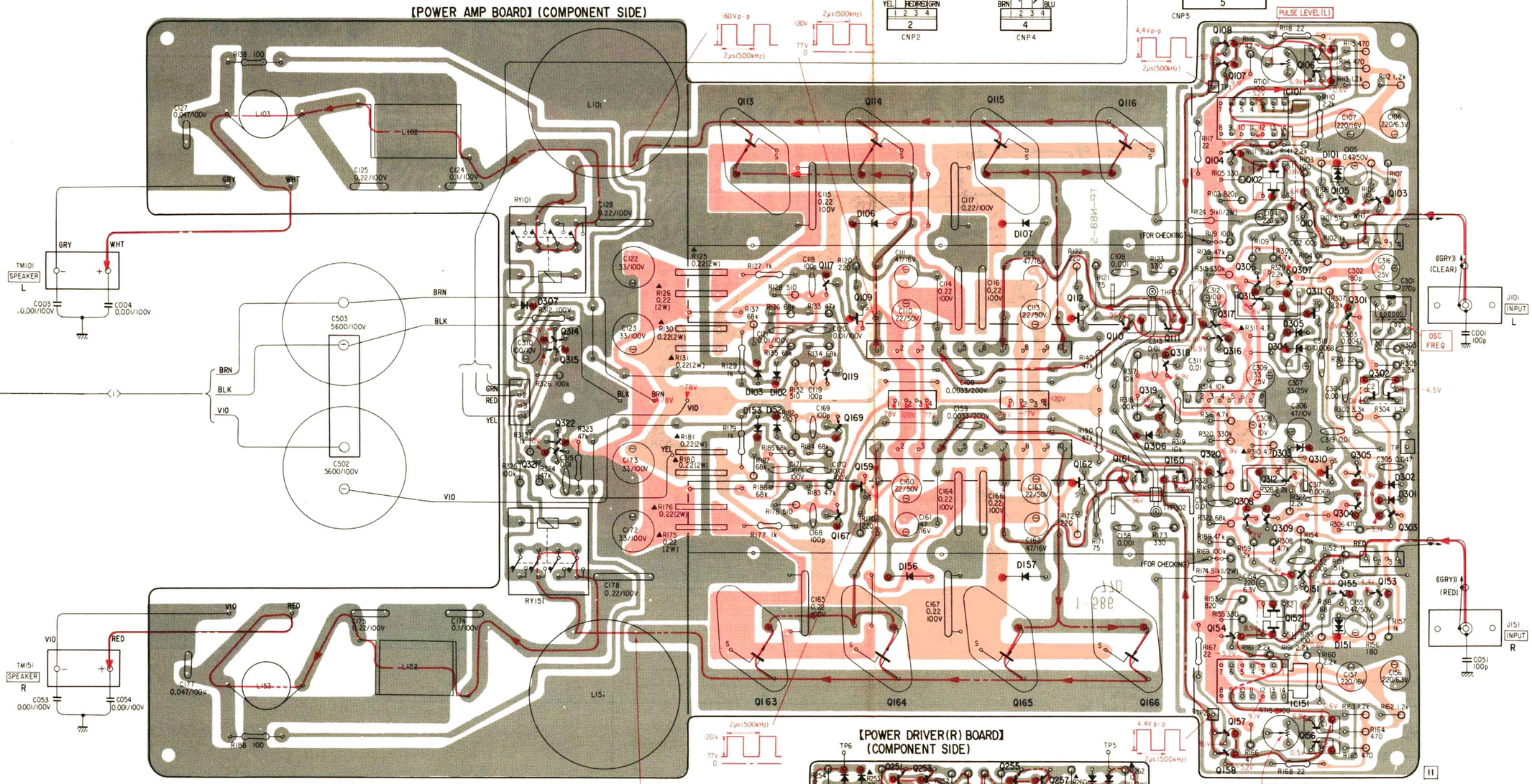


- ○—— : parts extracted from the component side.
- ●—— : parts extracted from the conductor side.
- [ ] : indicates side identified with part number.
- : B+ pattern.
- : B– pattern.
- Signal Path
  —→ : L-CH
  - - -→ : R-CH
- [ ] : AEP model
  < > : US model
  no mark : common
- ▲ : nonflammable resistor.
- Ⓕ : fusible resistor.

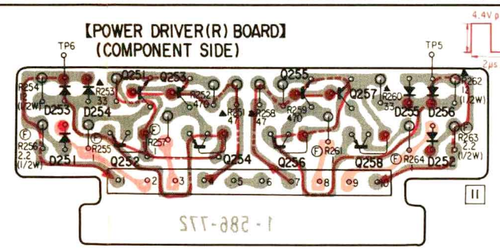
【POWER DRIVER(L) BOARD】
(COMPONENT SIDE)



【POWER AMP BOARD】(COMPONENT SIDE)

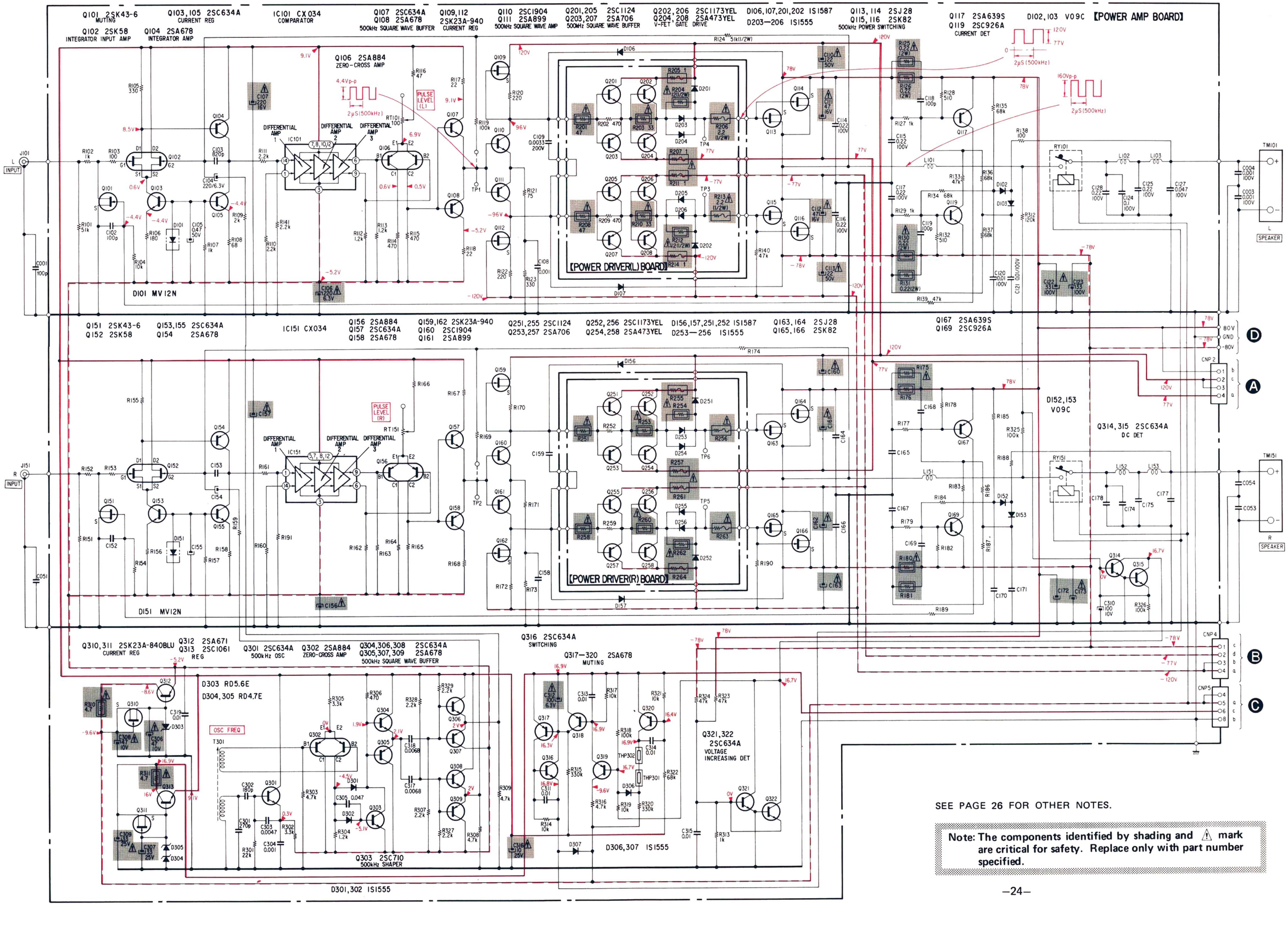


【POWER DRIVER(R) BOARD】
(COMPONENT SIDE)



Q, IC	D
202, 206 204, 208	201, 202
201, 205 203, 207	203, 205 204, 206
108	
107, 106	
IC101	
113 114 115 116	104 102 101
105, 103 101	
	106, 107
117 306, 307	
313	307
109, 112 314 110, 111	301 317 305
315 316	304
318 119	103, 102
302	
319	
169	153, 152
322	306 303
321 161, 160 310, 305	320 302
312 162 159 304 308, 309	301
303 167	
151	156, 157
155, 153	
152	151
154	
163 164 165 IC151 166	
157, 156	
158	
251, 255 253, 257	253, 255 254, 256
252, 256 254, 258	251, 252
Q, IC	D

4-3. SCHEMATIC DIAGRAM — *Amplifier Section* —



SEE PAGE 26 FOR OTHER NOTES.

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

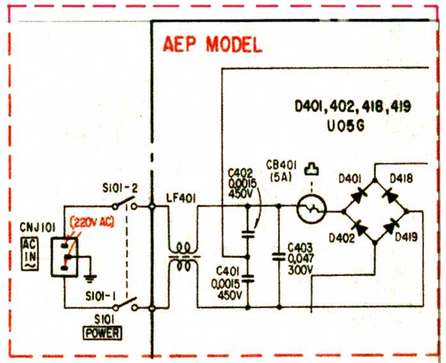
4-4. SCHEMATIC DIAGRAM — *Power Supply Section* —

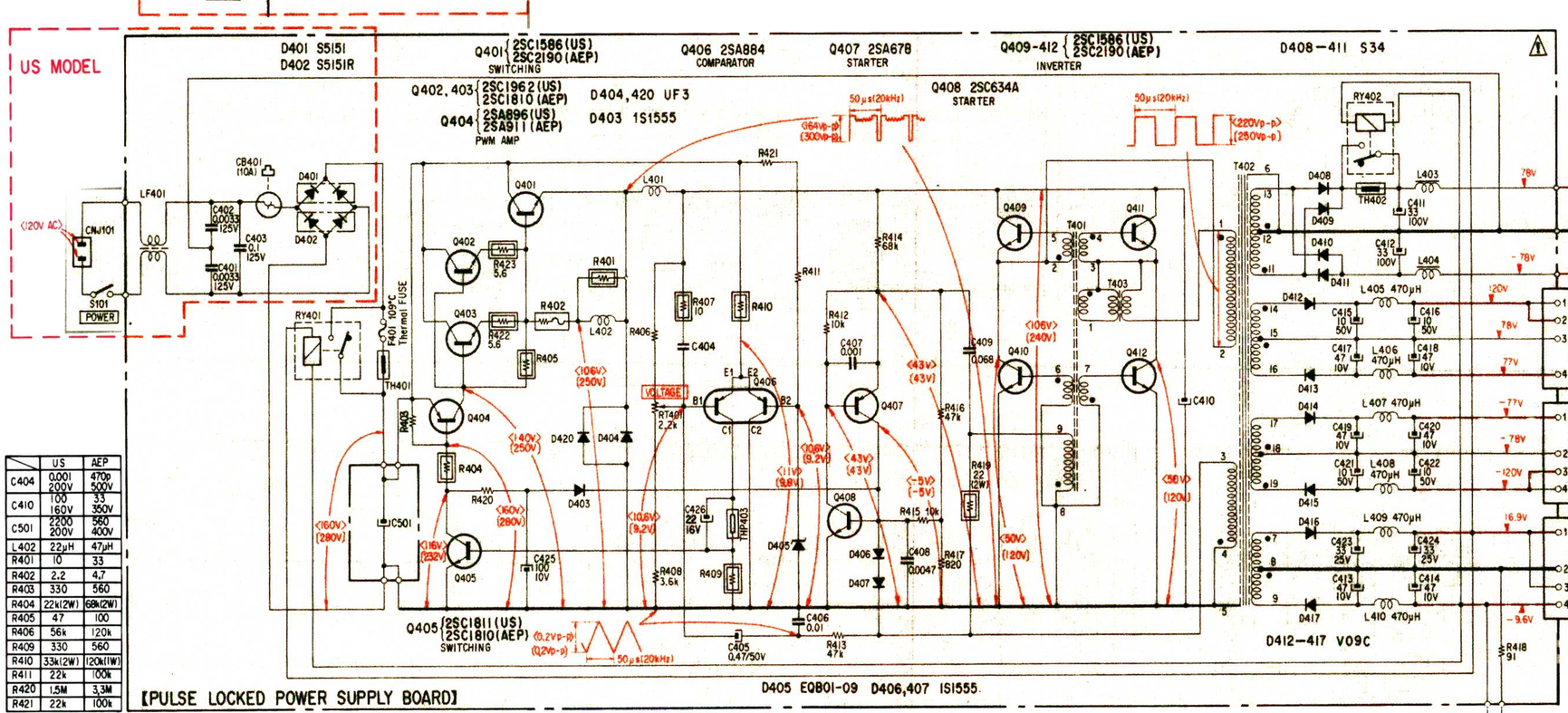
Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note:

- All capacitors are in μF unless otherwise noted. pF=μμF 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W unless otherwise noted. kΩ = 1000Ω, MΩ = 1000kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- : nonflammable resistor.
- : fusible resistor.
- : B+ bus.
- : panel designation.
- : adjustment for repair.
- : B− bus.
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20kΩ/V).
  [ ]: AEP model
  < >: US model
  no mark: common
- Voltage variations may be noted due to normal production tolerances.
- Switch

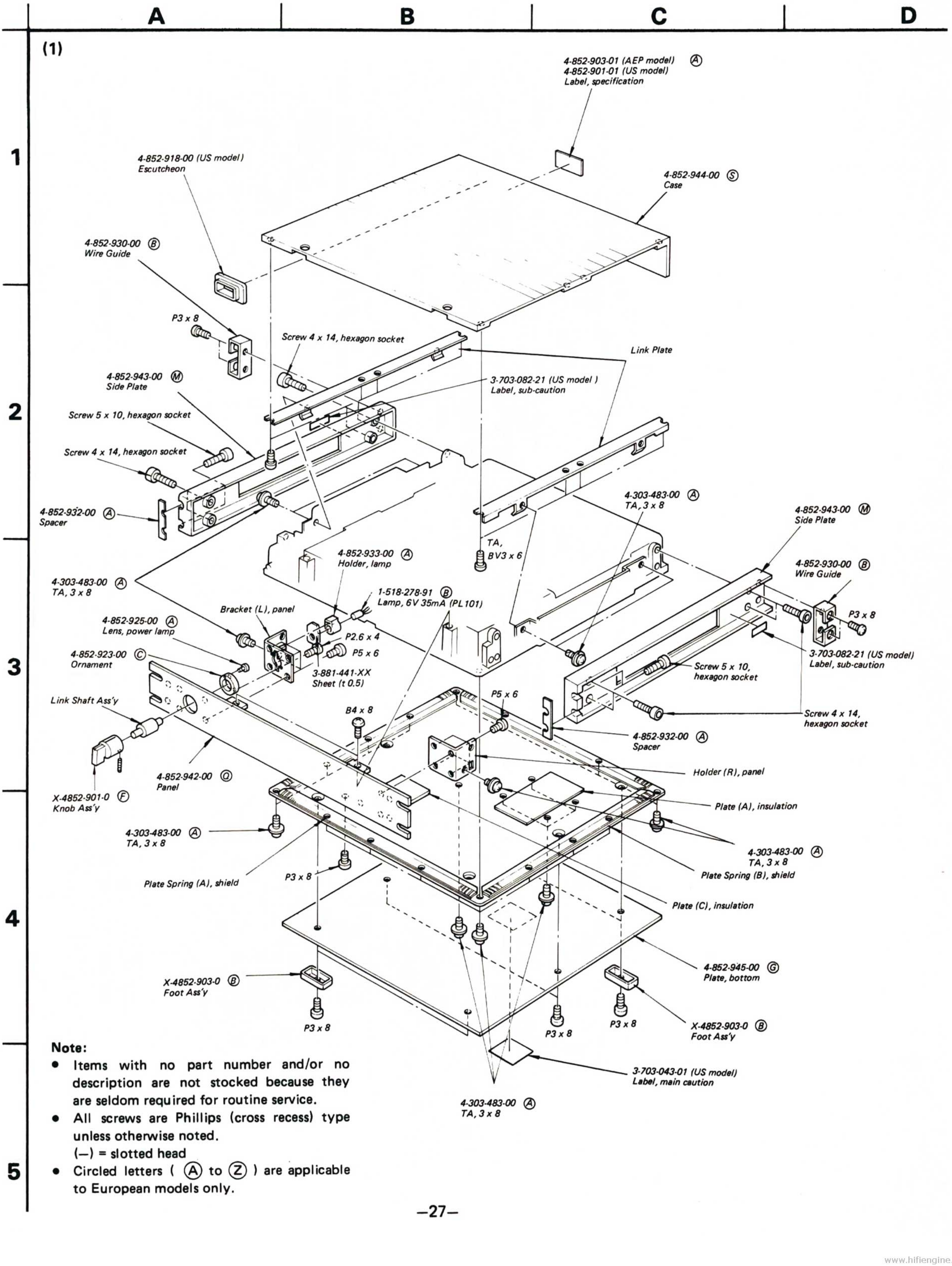
Ref. No.	Switch	Position
S101	POWER	OFF





	US	AEP
C404	0.001 200V	470p 500V
C410	100 160V	33 350V
C501	2200 200V	560 400V
L402	22μH	47μH
R401	10	33
R402	2.2	4.7
R403	330	560
R404	22k(2W)	68k(2W)
R405	47	100
R406	56k	120k
R409	330	560
R410	33k(2W)	120k(1W)
R411	22k	100k
R420	1.5M	3.3M
R421	22k	100k

SECTION 5
EXPLODED VIEWS



Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

(3)

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

SECTION 6
ELECTRICAL PARTS LIST

Ref. No.	*Part No.*	*Description*
		SEMICONDUCTORS
		Transistors
⇒Q101, 151		Ⓒ 2SK43-5
Q102, 152		Ⓕ 2SK58
Q103, 153		Ⓑ 2SC634A
Q104, 154		Ⓒ 2SA678
Q105, 155		Ⓑ 2SC634A
Q106, 156		Ⓓ 2SA884
Q107, 157		Ⓑ 2SC634A
Q108, 158		Ⓒ 2SA678
Q109, 159		Ⓑ 2SK23A-940
Q110, 160		Ⓑ 2SC1904
Q111, 161		Ⓒ 2SA899
Q112, 162		Ⓑ 2SK23A-940
Q113, 163		Ⓠ 2SJ28
Q114, 164		Ⓠ 2SJ28
Q115, 165		Ⓝ 2SK82
Q116, 166		Ⓝ 2SK82
Q117, 167		Ⓒ 2SA639S
Q119, 169		Ⓓ 2SC926A
Q201, 251		Ⓒ 2SC1124
Q202, 252		Ⓒ 2SC1173 yellow
Q203, 253		Ⓓ 2SA706
Q204, 254		Ⓒ 2SA473 yellow
Q205, 255		Ⓒ 2SC1124
Q206, 256		Ⓒ 2SC1173 yellow
Q207, 257		Ⓓ 2SA706
Q208, 258		Ⓒ 2SA473 yellow
Q301		Ⓑ 2SC634A
Q302		Ⓓ 2SA884
Q303		Ⓑ 2SC710
Q304		Ⓑ 2SC634A
Q305		Ⓒ 2SA678
Q306		Ⓑ 2SC634A
Q307		Ⓒ 2SA678
Q308		Ⓑ 2SC634A
Q309		Ⓒ 2SA678
Q310, 311		Ⓒ 2SK23-840 blue
Q312		Ⓔ 2SA671
Q313		Ⓓ 2SC1061
Q314–316		Ⓑ 2SC634A
Q317–320		Ⓒ 2SA678
Q321, 322		Ⓑ 2SC634A
Q401 ⚠		Ⓛ 2SC2190 (AEP model) 2SC1586 (US model)
Q402, 403 ⚠		Ⓔ 2SC1810 (AEP model) 2SC1962 (US model)
Q404 ⚠		Ⓗ 2SA911 (AEP model) 2SA896 (US model)
Q405 ⚠		Ⓔ 2SC1810 (AEP model) 2SC1811 (US model)
Q406 ⚠		Ⓓ 2SA884
Q407 ⚠		Ⓒ 2SA678
Q408 ⚠		Ⓑ 2SC634A
Q409–412 ⚠		Ⓛ 2SC2190
		IC
IC101, 151		Ⓘ CX034
		Diodes
D101, 151		Ⓑ MV12N
D102, 152		Ⓑ V09C
D103, 153		Ⓑ V09C
D106, 156		Ⓑ 1S1587
D107, 157		Ⓑ 1S1587
D201, 251		Ⓑ 1S1587
D202, 252		Ⓑ 1S1587
D203–206 D253–256		Ⓑ 1S1555
D301, 302		Ⓑ 1S1555
D303		Ⓑ RD5.6E
D304, 305		Ⓑ RD4.7E
D306, 307		1S1555
D401, 402 ⚠		Ⓒ U05G (AEP model) S5151 (US model) S5151R (US model)
D401 ⚠		
D402 ⚠		
D403 ⚠		Ⓑ 1S1555
D404 ⚠		Ⓔ UF3
D405 ⚠		Ⓑ EQB01-09
D406, 407 ⚠		Ⓑ 1S1555

Note:

- ⇒ : Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note:

- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Note:
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	*Part No.*	*Description*			
D408–411 ⚠		Ⓒ S34			
D412–417 ⚠		Ⓑ V09C			
D418, 419 ⚠		Ⓒ U05G (AEP model)			
D420 ⚠		Ⓔ UF3			

Thermistors

Th401, 402 ⚠	1-800-356-00	Ⓔ negative			
ThP301,302	1-800-340-21	Ⓑ positive			
ThP403 ⚠	1-800-340-11	Ⓑ positive			

COILS

L101, 151 ⚠	1-421-332-00	Choke (US model)			
L401 ⚠	1-421-331-00	Choke (US model)			
L401 ⚠	1-421-335-00	Ⓗ Choke (AEP model)			
L402 ⚠	1-407-161-XX	22μH, microinductor (US model)			
L402 ⚠	1-407-165-XX	Ⓐ 47μH, microinductor (AEP model)			
L403, 404 ⚠	1-421-329-00	Ⓑ Choke			
L405–410 ⚠	1-407-488-31	Ⓑ 470μH, microinductor			

TRANSFORMERS

T301	1-405-391-11	Ⓑ Coil, osc frequency adj.			
T401 ⚠	1-435-057-00	Ⓔ Osc			
T402 ⚠	1-442-960-00	Converter (US model)			
T402 ⚠	1-442-961-00	Ⓝ Converter (AEP model)			
T403 ⚠	1-543-098-00	Ⓑ Core			

CAPACITORS

All capacitors are in μF and ceramic unless otherwise noted.
50WV or less are not indicated except for electrolytics.
pF = μμF, elect = electrolytic

C1, 51	1-102-975-11	Ⓐ 100p			
C3, 53 C4, 54)	1-108-365-12	Ⓐ 0.001	100V	mylar	
C102, 152	1-102-975-11	Ⓐ 100p			
C103, 153	1-104-075-11	Ⓑ 820p		polystyrol	
C104, 154	1-131-427-11	Ⓕ 220	6.3V	tantalum	
C105, 155	1-121-726-11	Ⓐ 0.47	50V	elect	
C106, 156 ⚠	1-123-198-11	Ⓑ 220	6.3V	elect	
C107, 157 ⚠	1-123-068-11	Ⓑ 220	16V	elect	
C108, 158	1-102-074-11	Ⓐ 0.001			
C109, 159	1-108-686-12	Ⓐ 0.0033	200V	mylar	
C110, 160 ⚠	1-123-056-11	Ⓑ 22	50V	elect	
C111, 161 C112, 162) ⚠	1-123-192-11	Ⓐ 47	16V	elect	
C113, 163 ⚠	1-123-056-11	Ⓑ 22	50V	elect	
C114–117 C164–167)	1-130-085-11	Ⓑ 0.22	100V	polyethylene	
C118, 168 C119, 169)	1-102-975-11	Ⓐ 100p			
C120, 170 C121, 171) ⚠	1-106-196-12	Ⓑ 0.01	100V	mylar	
C122, 172 C123, 173)	1-123-287-11	Ⓒ 33	100V	elect	
C124, 174	1-108-638-12	Ⓑ 0.1	100V	mylar	
C125, 175	1-130-085-11	Ⓑ 0.22	100V	polyethylene	
C127, 177	1-108-634-12	Ⓐ 0.047	100V	mylar	
C128, 178	1-130-085-11	Ⓑ 0.22	100V	polyethylene	
C301	1-104-063-11	Ⓑ 270p		polystyrol	
C302	1-104-059-11	Ⓑ 180p		polystyrol	
C303	1-108-234-12	Ⓐ 0.0047		mylar	
C304	1-108-227-12	Ⓐ 0.001		mylar	
C305	1-108-246-12	Ⓐ 0.047		mylar	
C306 ⚠	1-123-195-11	Ⓐ 47	10V	elect	
C307 ⚠	1-123-189-11	Ⓐ 33	25V	elect	
C308 ⚠	1-123-195-11	Ⓐ 47	10V	elect	
C309 ⚠	1-123-189-11	Ⓐ 33	25V	elect	
C310 ⚠	1-123-196-11	Ⓐ 100	10V	elect	
C311	1-108-239-12	Ⓐ 0.01		mylar	
C312 ⚠	1-123-197-11	Ⓐ 100	6.3V	elect	
C313–315	1-108-239-12	Ⓐ 0.01		mylar	
C316 ⚠	1-123-187-11	Ⓐ 10	25V	elect	
C317, 318	1-108-237-12	Ⓐ 0.0068		mylar	
C319	1-108-239-12	Ⓐ 0.01		mylar	
C401, 402 ⚠	1-161-437-11	0.0033	125V	US model)	
C401, 402 ⚠	1-115-149-11	Ⓒ 0.0015	450V	oil paper (AEP model)	
C403 ⚠	1-108-747-12	0.1	125V	mylar (US model)	

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note:

- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	*Part No.*	*Description*		
C403	⚠1-108-749-12	Ⓒ 0.047	300V (AEP model)	mylar
C404	⚠1-108-409-12	0.001	200V (US model)	mylar
C404	⚠1-107-016-12	Ⓐ 470p	500V (AEP model)	mylar
C405	⚠1-121-726-11	Ⓐ 0.47	50V	elect
C406	⚠1-108-239-12	Ⓐ 0.01		mylar
C407	⚠1-108-227-12	Ⓐ 0.001		mylar
C408	⚠1-108-234-12	Ⓐ 0.0047		mylar
C409	⚠1-108-249-12	Ⓐ 0.068		mylar
C410	⚠1-123-283-11	100	160V (US model)	elect
C410	⚠1-123-280-11	Ⓒ 33	350V (AEP model)	elect
C411, 412	⚠1-123-287-11	Ⓒ 33	100V	elect
C413, 414	⚠1-123-195-11	Ⓐ 47	10V	elect
C415, 416	⚠1-123-183-11	Ⓐ 10	50V	elect
C417–420	⚠1-123-195-11	Ⓐ 47	10V	elect
C421, 422	⚠1-123-183-11	Ⓐ 10	50V	elect
C423, 424	⚠1-123-189-11	Ⓐ 33	25V	elect
C425	⚠1-123-196-11	Ⓐ 100	10V	elect
C426	⚠1-123-191-11	Ⓐ 22	16V	elect
C501	1-125-164-11	Ⓚ 560	400V (AEP model)	elect
C501	1-125-165-11	2200	200V (US model)	elect
C502, 503	1-125-166-11	Ⓙ 5600	100V	elect

RESISTORS

All resistors are in ohms. Common ¼W carbon resistors are omitted. Refer to the list on the last page for their part numbers.

R124	⚠1-244-914-11	Ⓐ 51k	½W	
R125, 126 R130, 131	⚠1-217-151-11	Ⓐ 0.22	2W	wirewound
R174	⚠1-244-914-11	Ⓐ 51k	½W	
R175, 176 R180, 181	⚠1-217-151-11	Ⓐ 0.22	2W	wirewound
R201	⚠1-211-514-11	Ⓐ 47	¼W (nonflammable)	carbon
R203	⚠1-211-510-11	Ⓐ 33	¼W (nonflammable)	carbon
R204	⚠1-211-592-11	Ⓐ 12	½W (nonflammable)	carbon
R205	⚠1-217-375-11	Ⓑ 1	¼W	fusible
R206	⚠1-217-426-11	Ⓑ 2.2	2W	fusible
R207	⚠1-217-375-11	Ⓑ 1	¼W	fusible
R208	⚠1-211-514-11	Ⓐ 47	¼W (nonflammable)	carbon
R210	⚠1-211-510-11	Ⓐ 33	¼W (nonflammable)	carbon
R211	⚠1-217-375-11	Ⓑ 1	¼W	fusible
R212	⚠1-211-592-11	Ⓐ 12	½W (nonflammable)	carbon
R213	⚠1-217-426-11	Ⓑ 2.2	½W	fusible
R214	⚠1-217-375-11	Ⓑ 1	¼W	fusible
R251	⚠1-211-514-11	Ⓐ 47	¼W (nonflammable)	carbon
R253	⚠1-211-510-11	Ⓐ 33	¼W (nonflammable)	carbon
R254	⚠1-211-592-11	Ⓐ 12	½W	
R255	⚠1-217-375-11	Ⓑ 1	¼W	fusible
R256	⚠1-217-426-11	Ⓑ 2.2	½W	fusible
R257	⚠1-217-375-11	Ⓑ 1	¼W	fusible
R258	⚠1-211-514-11	Ⓐ 47	¼W (nonflammable)	carbon
R260	⚠1-211-510-11	Ⓐ 33	¼W (nonflammable)	carbon
R261	⚠1-217-375-11	Ⓑ 1	¼W	fusible
R262	⚠1-211-592-11	Ⓐ 12	½W	
R263	⚠1-217-426-11	Ⓑ 2.2	½W	fusible
R264	⚠1-217-375-11	Ⓑ 1	¼W	fusible
R310, 311	⚠1-211-490-11	Ⓐ 4.7	¼W (nonflammable)	carbon
R401	⚠1-211-498-11	10	¼W (nonflammable) (US model)	carbon
R401	⚠1-211-510-11	Ⓐ 33	¼W (nonflammable) (AEP model)	carbon
R402	⚠1-217-379-11	2.2	¼W (US model)	fusible

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note:

- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	*Part No.*		*Description*		
R402	⚠1-217-383-11	Ⓑ	4.7	¼W	fusible (AEP model)
R403	⚠1-242-661-11		330	¼W	(US model)
R403	⚠1-242-667-11	Ⓐ	560	¼W	(AEP model)
R404	⚠1-206-696-11		22k	2W	metal oxide (US model)
R404	⚠1-214-475-11	Ⓐ	68k	2W	metal oxide (AEP model)
R405	⚠1-211-514-11		47	¼W	carbon (nonflammable (US model)
R405	⚠1-211-522-11	Ⓐ	100	¼W	carbon (nonflammable) (AEP model)
R406	⚠1-244-715-11	Ⓐ	56k	¼W	
R406	⚠1-244-723-11	Ⓐ	120k		
R407	⚠1-211-498-11	Ⓐ	10	¼W	carbon (nonflammable)
R408	⚠1-224-686-11	Ⓐ	3.6k	¼W	
R409	⚠1-211-534-11		330	¼W	carbon (nonflammable) (US model)
R409	⚠1-211-540-11	Ⓐ	560	¼W	carbon (nonflammable) AEP model)
R410	⚠1-206-700-11		33k	2W	metal oxide (US model)
R410	⚠1-206-801-11	Ⓑ	120k	1W	composition (AEP model)
R411	⚠1-244-705-11		22k	¼W	(US model)
R411	⚠1-244-721-11	Ⓐ	100k	¼W	(AEP model)
R412	⚠1-244-697-11	Ⓐ	10k	¼W	
R413	⚠1-244-713-11	Ⓐ	47k	¼W	
R414	⚠1-244-717-11	Ⓐ	68k	¼W	
R415	⚠1-244-697-11	Ⓐ	10k	¼W	
R416	⚠1-244-713-11	Ⓐ	47k	¼W	
R417	⚠1-244-671-11	Ⓐ	820	¼W	
R418	⚠1-244-648-11	Ⓐ	91	¼W	
R419	⚠1-206-471-11	Ⓐ	22	2W	metal oxide
R420	⚠1-210-817-11		1.5M	¼W	(US model)
R420	⚠1-210-825-11	Ⓐ	3.3M	¼W	(AEP model)
R421	⚠1-244-705-11		22k	¼W	(US model)
R421	⚠1-244-721-11	Ⓐ	100k	¼W	(AEP model)
R422, 423	⚠1-211-492-11	Ⓐ	5.6	¼W	

SWITCHES

S101	⚠1-552-294-12	Rotary, POWER (US model)
S101	⚠1-552-295-12	Rotary, POWER (AEP model)

Ref. No.	*Part No.*		*Description*

JACKS

J101, 151	1-507-287-31	Ⓐ	1p
CNJ101	⚠1-509-062-31		Socket, AC IN (US model)
CNJ101	⚠1-509-547-00	Ⓒ	Socket, 3p AC IN (AEP model)

MISCELLANEOUS

CB401	⚠1-532-493-12		Circuit Breaker 10A (US model)
CB401	⚠1-532-533-11	Ⓒ	Circuit Breaker 5A (AEP model)
F401	⚠1-532-496-00	Ⓒ	Fuse, 190°C
LF401	⚠1-421-259-00	Ⓕ	Line Filter Coil
PL101	1-518-278-91	Ⓑ	Lamp, 6V 35mA
RT101,151	1-224-247-XX	Ⓒ	100, adjustable
RT401	1-224-249-XX	Ⓑ	1k, adjustable
RY101,151	1-515-257-00	Ⓗ	Relay
RY401,402	⚠1-515-278-00	Ⓕ	Relay
TM101	1-535-195-21	Ⓕ	Terminal, 2p white
TM151	1-535-195-31	Ⓕ	Terminal, 2p red
	1-525-186-00	Ⓑ	Socket, transistor

ACCESSORIES & PACKING MATERIALS

Part No.		*Description*
⚠1-534-262-XX	Ⓔ	Cord, power
3-701-020-00	Ⓐ	Bag, plastic; printed matters
3-770-082-21		Manual, instruction (US model)
3-770-282-11	Ⓗ	Manual, instruction (AEP model)
4-809-251-00	Ⓐ	Bag, plastic
4-852-949-00	Ⓒ	Cushion
4-852-952-00	Ⓕ	Carton

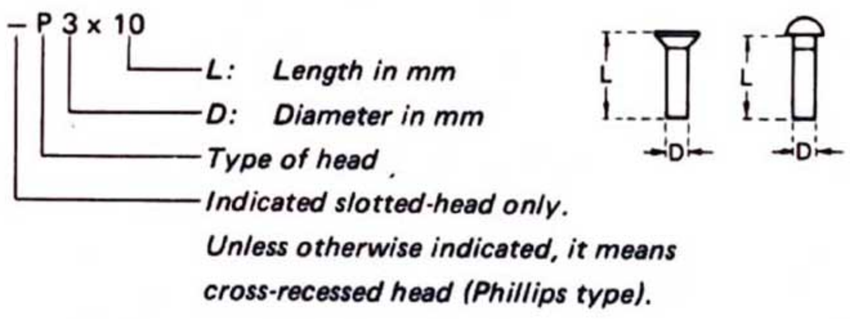
Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

1/4 WATT CARBON RESISTORS

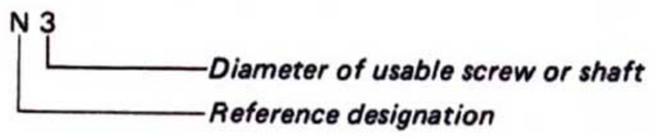
Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.
1.0	1-244-601-11	10	1-244-625-11	100	1-244-649-11	1.0k	1-244-673-11	10k	1-244-697-11	100k	1-244-721-11	1.0M	1-244-745-11
1.1	1-244-602-11	11	1-244-626-11	110	1-244-650-11	1.1k	1-244-674-11	11k	1-244-698-11	110k	1-244-722-11	1.1M	1-244-746-11
1.2	1-244-603-11	12	1-244-627-11	120	1-244-651-11	1.2k	1-244-675-11	12k	1-244-699-11	120k	1-244-723-11	1.2M	1-244-747-11
1.3	1-244-604-11	13	1-244-628-11	130	1-244-652-11	1.3k	1-244-676-11	13k	1-244-700-11	130k	1-244-724-11	1.3M	1-244-748-11
1.5	1-244-605-11	15	1-244-629-11	150	1-244-653-11	1.5k	1-244-677-11	15k	1-244-701-11	150k	1-244-725-11	1.5M	1-244-749-11
1.6	1-244-606-11	16	1-244-630-11	160	1-244-654-11	1.6k	1-244-678-11	16k	1-244-702-11	160k	1-244-726-11	1.6M	1-244-750-11
1.8	1-244-607-11	18	1-244-631-11	180	1-244-655-11	1.8k	1-244-679-11	18k	1-244-703-11	180k	1-244-737-11	1.8M	1-244-751-11
2.0	1-244-608-11	20	1-244-632-11	200	1-244-656-11	2.0k	1-244-680-11	20k	1-244-704-11	200k	1-244-728-11	2.0M	1-244-752-11
2.2	1-244-609-11	22	1-244-633-11	220	1-244-657-11	2.2k	1-244-681-11	22k	1-244-705-11	220k	1-244-729-11	2.2M	1-244-753-11
2.4	1-244-610-11	24	1-244-634-11	240	1-244-658-11	2.4k	1-244-682-11	24k	1-244-706-11	240k	1-244-730-11	2.4M	1-244-754-11
2.7	1-244-611-11	27	1-244-635-11	270	1-244-659-11	2.7k	1-244-683-11	27k	1-244-707-11	270k	1-244-731-11	2.7M	1-244-755-11
3.0	1-244-612-11	30	1-244-636-11	300	1-244-660-11	3.0k	1-244-684-11	30k	1-244-708-11	300k	1-244-732-11	3.0M	1-244-756-11
3.3	1-244-613-11	33	1-244-637-11	330	1-244-661-11	3.3k	1-244-685-11	33k	1-244-709-11	330k	1-244-733-11	3.3M	1-244-757-11
3.6	1-244-614-11	36	1-244-638-11	360	1-244-662-11	3.6k	1-244-686-11	36k	1-244-710-11	360k	1-244-734-11	3.6M	1-244-758-11
3.9	1-244-615-11	39	1-244-639-11	390	1-244-663-11	3.9k	1-244-687-11	39k	1-244-711-11	390k	1-244-735-11	3.9M	1-244-759-11
4.3	1-244-616-11	43	1-244-640-11	430	1-244-664-11	4.3k	1-244-688-11	43k	1-244-712-11	430k	1-244-736-11	4.3M	1-244-760-11
4.7	1-244-617-11	47	1-244-641-11	470	1-244-665-11	4.7k	1-244-689-11	47k	1-244-713-11	470k	1-244-737-11	4.7M	1-244-761-11
5.1	1-244-618-11	51	1-244-642-11	510	1-244-666-11	5.1k	1-244-690-11	51k	1-244-714-11	510k	1-244-738-11	5.1M	1-244-762-11
5.6	1-244-619-11	56	1-244-643-11	560	1-244-667-11	5.6k	1-244-691-11	56k	1-244-715-11	560k	1-244-739-11		
6.2	1-244-620-11	62	1-244-644-11	620	1-244-668-11	6.2k	1-244-692-11	62k	1-244-716-11	620k	1-244-740-11		
6.8	1-244-621-11	68	1-244-645-11	680	1-244-669-11	6.8k	1-244-693-11	68k	1-244-717-11	680k	1-244-741-11		
7.5	1-244-622-11	75	1-244-646-11	750	1-244-670-11	7.5k	1-244-694-11	75k	1-244-718-11	750k	1-244-742-11		
8.2	1-244-623-11	82	1-244-647-11	820	1-244-671-11	8.2k	1-244-695-11	82k	1-244-719-11	820k	1-244-743-11		
9.1	1-244-624-11	91	1-244-648-11	910	1-244-672-11	9.1k	1-244-696-11	91k	1-244-720-11	910k	1-244-744-11		

HARDWARE NOMENCLATURE

Screw:



Nut, Washer, Retaining ring:



Reference Designation	Shape	Description	Remarks
SCREWS			
P		pan-head screw	binding-head (B) screw for replacement
PWH		pan-head screw with washer face	binding-head (B) screw and flat washer for replacement
PS PSP		pan-head screw with spring washer	binding-head (B) screw and spring washer for replace-ment
PSW PSPW		pan-head screw with spring and flat washers	binding-head (B) screw and spring and flat washers for replacement
R		round-head screw	binding-head (B) screw for replacement
K		flat-countersunk-head screw	
RK		oval-countersunk-head screw	
B		binding-head screw	
T		truss-head screw	binding-head (B) screw for replacement
F		flat-fillister-head screw	
RF		fillister-head screw	
BV		braizer-head screw	

Reference Designation	Shape	Description	Remarks
SELF-TAPPING SCREWS			
TA		self-tapping screw	ex: TA, P 3 x 10
PTP		pan-head self-tapping screw	binding-head self-tapping (TA, B) screw for replacement
PTPWH		pan-head self-tapping screw with washer face	binding-head self tapping (TA, B) screw and flat washer for replacement
PTTWH		pan-head thread-rolling screw with washer face	binding-head (B) screw and flat washer for replacement
SET SCREWS			
SC		set screw	
SC		hexagon-socket set screw	ex: SC 2.6 x 4, hexagon socket
NUT			
N		nut	
WASHERS			
W		flat washer	
SW		spring washer	
LW		internal-tooth lock washer	ex: LW3, internal
LW		external-tooth lock washer	ex: LW3, external
RETAINING RINGS			
E		retaining ring	
G		grip-type retaining ring	

Sony Corporation