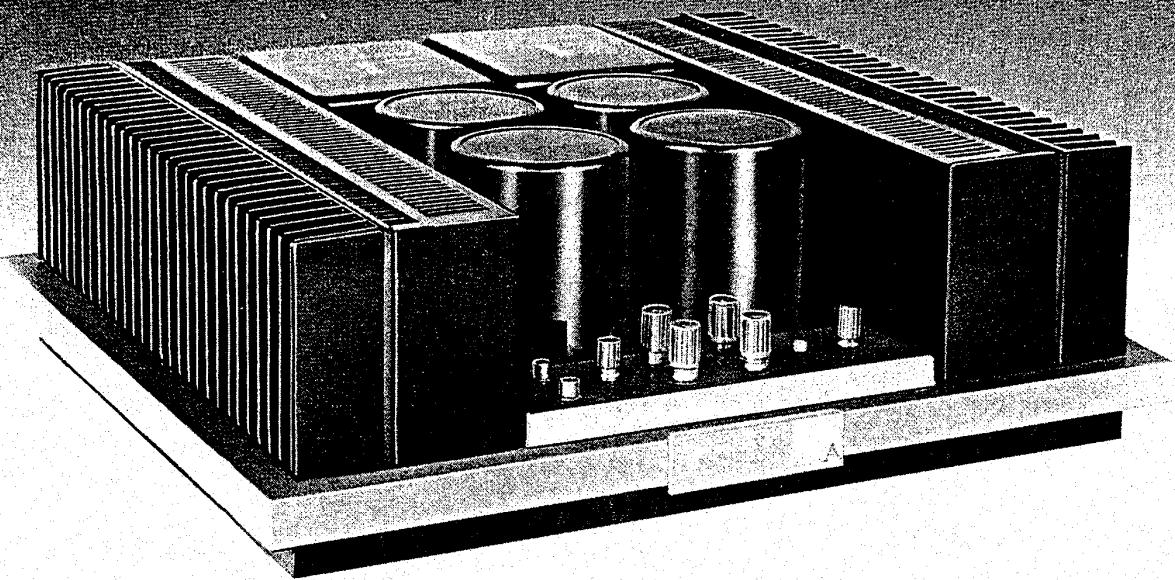


STEREO POWER AMPLIFIER

M-22

SERVICE MANUAL



 PIONEER®

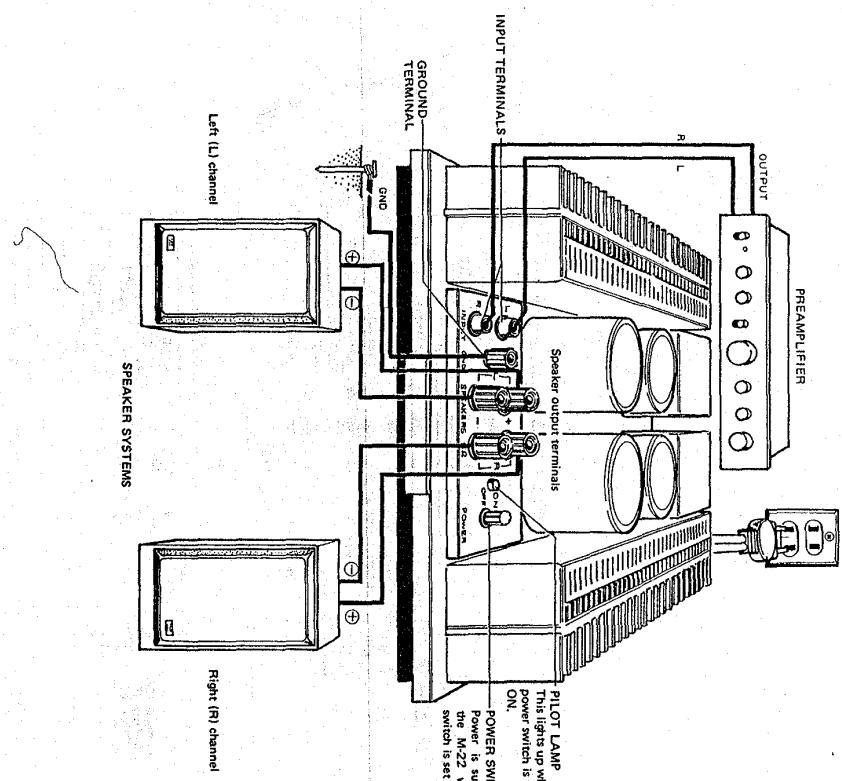
1. SPECIFICATIONS

Semiconductors	
Transistors	44
Diodes	66(KL-type), 65(N-type)
Amplifier Section	
Circuitry	2-stage Differential push-pull, 2-stage Darlington connection, parallel push-pull, direct-coupled OCL (Class A operation)
Continuous Power Output from 10 Hertz to 30,000 Hertz (Both channels driven)	30 watts per channel (8 ohms)
Total Harmonic Distortion at 10Hz to 30,000Hz	
Continuous rated power output	0.01%
15 watts per channel power output	0.005%
1 watt per channel power output, 8 ohms	0.005%
Intermodulation Distortion (50Hz: 7kHz = 4:1)	
Continuous rated power output	0.01%
15 watts per channel power output, 8 ohms	0.01%
1 watt per channel power output, 8 ohms	0.01%
Frequency Response	2Hertz to 150,000Hertz +1dB
Input (Sensitivity/Impedance)	1V/50kilohms
Output	
SPEAKER	8 ohms
Damping Factor (20Hertz to 20,000Hertz, 8 ohms)	60
Hum and Noise (IHF, short-circuited A network)	16db
Miscellaneous	
Power Requirements	120V 60Hz (KL-type) 220V 50/60Hz (N-type)
Power Consumption	280 watts (UL)
Dimensions	420(W)x151(H)x370(D) mm 16.9(16.6-1/32)-14.9(16 in.
Weight	Without Package: 22kg (48 lb 7 oz) With Package: 24.7 kg (54 lb 6 oz)

NOTE:
Specifications and the design subject to possible modification without notice due to improvements.

- Furnished Parts
- Connection Cord with Pin plugs 1
- Operating Instructions 1

2. CONNECTION DIAGRAM



M-22

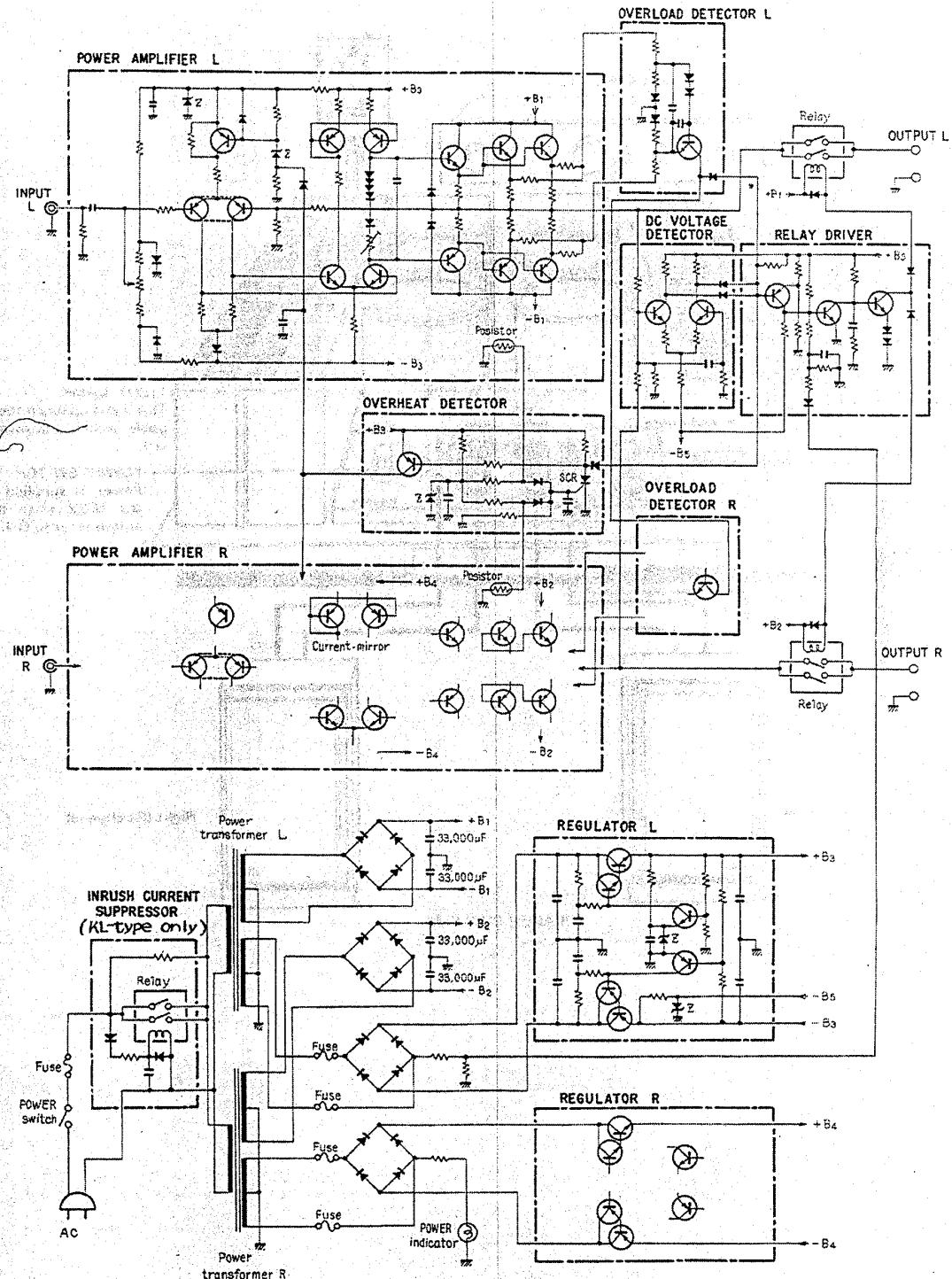
MODEL M-22 COMES IN TWO VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
K.L.	120V only	U.S.A. model
N	220V only	General export model

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3. BLOCK DIAGRAM



4. CIRCUIT DESCRIPTIONS

4.1 AMPLIFIER SECTION

The first stage is a low noise twin transistor (Q1) differential amplifier. The twin transistor consists of two transistors having the same characteristics mounted in a single unit. Consequently, the two transistors are subjected to the same thermal conditions and are ideal as a differential amplifier. Neutral potential drift is also suppressed by using the forward voltage of silicon diodes D1 and D2 which have matched temperature coefficients in the offset voltage adjustment circuit so that temperature changes are mutually cancelled.

The predictor stage is a differential amplifier (Q2, Q3) with current mirror (Q4, Q5) and is operated as a push-pull amplifier. The base of Q4 is connected to the collector and is equivalent to a diode,

The base-to-emitter voltage generated at Q4 by the collector current of Q2 forward biases Q5. Q4 and Q5 are the same type and if R14 and R15 are equivalent, the emitter current of Q4 and Q5 also becomes equivalent. If the common emitter current transfer ratio of Q4 and Q5 is made sufficiently large, the collector current of Q5 equals the collector current of Q2. Therefore, Q3 and Q5 are operated in a push-pull arrangement.

The power stage is a 2-stage Darlington connection SEPP.

The final stage power transistors are connected in parallel.

The idle current is 0.85A/transistor. Operation is Class A.

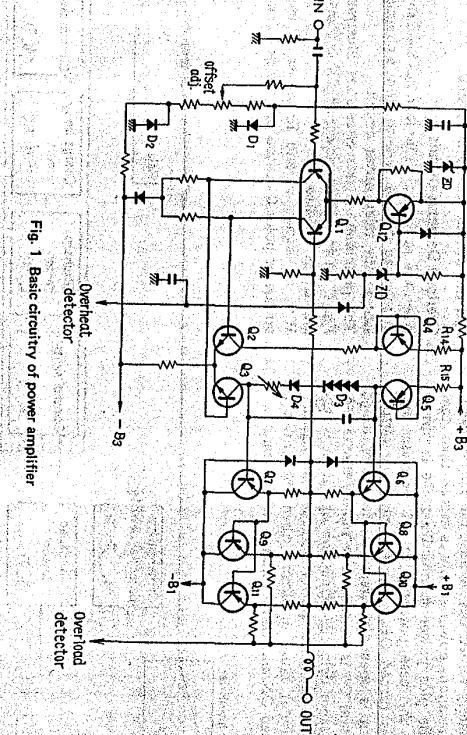


Fig. 1 Basic circuitry of power amplifier

4.2 PROTECTION CIRCUIT

The amplifier and speakers are safeguarded by a protection circuit which employs a relay to automatically open and close the output circuit. This circuit consists of four parts (Fig. 2).

1. Relay Driver Circuit (Fig. 3)

This circuit controls the operation of the relay. Delay connection at power ON and muting at power OFF and disconnection (see items 2-4) based on commands from the detection circuits are performed by this circuit.

Muting Operation

When the power is turned ON, the base of Q6 is reverse biased and Q6 remains OFF. Q5 also normally remains OFF. When C4 is charged thru R22 and R23, the base potential of Q7 rises and Q7 is turned ON. Current then flows in the relay coils (RL2, RL3), the relay contacts are closed and the output circuit is connected. When the power is turned OFF, the base of Q6 is momentarily forward biased and Q6 is immediately turned ON because the time constant of the minus power supply is shorter than that of the plus power supply. When Q6 is turned ON, the base potential of Q7 decreases and Q7 is turned OFF. Consequently, the output circuit is opened. Moreover, since Q6 is turned ON and C4 is subsequently rapidly discharged, the same delayed connection operation is performed when the power is turned ON again. Transient noise occurring when the power is turned ON and OFF is muted in this manner.

Power amplifier

When the power amplifier load has been shorted or the load impedance is too low, a command is sent to the relay driver circuit.

The principles of this circuit are illustrated in Fig. 4. Qa and Qb are power amplifier transistors and RL is the load.

With no signal, Ia and Ib are equal and the voltage at point C (output neutral point) is zero. When the power amplifier load has been shorted or the load impedance is too low, a command is sent to the relay driver circuit.

The principles of this circuit are illustrated in Fig. 4. Qa and Qb are power amplifier transistors and RL is the load.

With no signal, Ia and Ib are equal and the

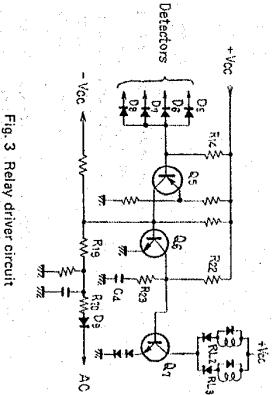


Fig. 3 Relay driver circuit

Operation by Detector Circuit Command

Detector circuit commands are actually current flowing in D5, D6, D7 or D8. Normally, Q5 is in the OFF state. When current flows in D5, D6, D7 or D8, a voltage is generated across R14. This voltage forward biases Q1 turning it ON. Thereupon, Q6 is turned ON, Q7 is turned OFF and the output circuit is opened.

2. Overload Detector Circuit

When the power amplifier load has been shorted or the load impedance is too low, a command is sent to the relay driver circuit.

The principles of this circuit are illustrated in Fig. 4. Qa and Qb are power amplifier transistors and RL is the load.

With no signal, Ia and Ib are equal and the

voltage at point C (output neutral point) is zero. Since Qa and Qb are operated in a Class A push-pull configuration, the amount of increase of Ia and the amount of decrease of Ib are equal, and the potential difference between point A and point B remains the same as with no signal. Since D2 is turned OFF by a rise in the voltage at point B, the voltage at point E becomes almost equal to that at point B. Therefore, the difference in potential between point D and point B is applied to the base of Q1 thru D3 and D4. Since the difference between Ia and Ib becomes greater as RL is made smaller, the potential difference between point A and point C becomes larger. Consequently, if RL is too small, the level shift by VF of D3 and D4 is exceeded, current flows in Q1 turning it ON. This causes current to flow in D5. Thus current becomes a command to the relay driver circuit. If RL is sufficiently large, the voltage of point E becomes higher than that of point D. Q1 is reverse biased and is turned OFF.

At the negative half cycle of the signal, Ib increases, Ia decreases, their resultant current flows through RL and a negative voltage is generated at point C. Since D1 is turned OFF by the voltage drop at point A, the voltage of point D becomes almost equal to that at point A. Therefore, the difference of potential difference between point A and point E is applied to the base of Q1 thru D3 and D4. Since the difference between Ia and Ib becomes greater as RL is made smaller, the potential difference between point B and point C becomes larger. Consequently, if RL is too small, the level shift by VF of D3 and D4 is exceeded, current flows in Q1 turning it ON. This causes current to flow in D5. This current becomes a command to the relay driver circuit. If RL is sufficiently large, the voltage at point D becomes lower than that at point E. Q1 is reverse biased and is turned OFF.

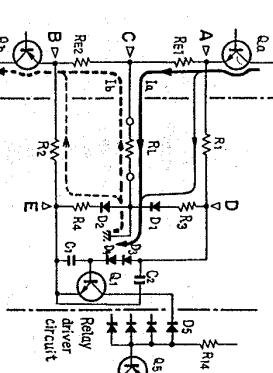


Fig. 4 Overload detector circuit

3. Center Point Potential Detector Circuit

When a DC potential is generated at the output center point of the power amplifier, a command is sent to the relay driver circuit. The principles of this circuit are illustrated in Fig. 5. Q3 and Q4 form a differential amplifier. Therefore, there is no output even if the same input is applied to the bases of both transistors. The output center point is normally only an AC signal. Since the reactance of C2 is sufficiently low, the same signal is applied to Q3 and Q4 and no output appears at their collectors. When a DC potential is produced at the output center point, input is only applied to Q3. If this DC potential is positive, the collector current of Q3 increases and the collector current of Q4 decreases. Therefore, the collector voltage voltage produced at the output center point is negative, the collector current of Q4 increases. Therefore, the collector voltage of Q4 drops and current flows in D6.

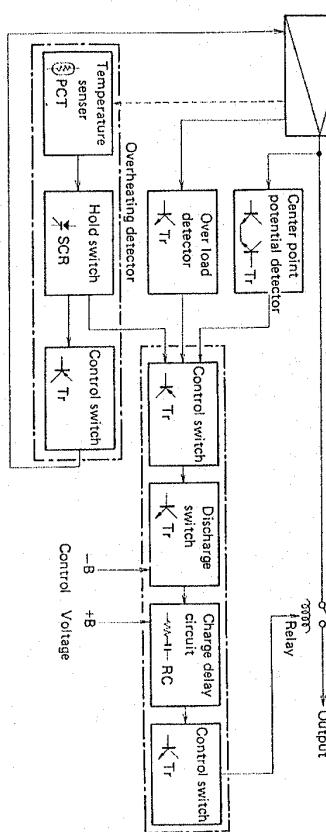


Fig. 2 Block diagram of protection circuit

Fig. 5 Center point potential detector

4. Overheating Detector Circuit

This circuit detects overheating of the heat sink for the power transistors.

A PCT (Positive Coefficient Thermistor) is used as the sensor. When the temperature of the PCT exceeds the rated temperature, its resistance increases abruptly.

Q_9 and Q_{10} in Fig. 6 are the first stage of the power amplifier. Q_8 is normally in the OFF state and Q_9 provides constant-current drive for the differential amplifier (Q_{10}).

The PCT is mounted at the heat sink and its resistance increases abruptly when the temperature of the heat sink exceeds the specified value. Thereupon, the gate voltage of the SCR (Silicon Controlled Rectifier) exceeds the trigger voltage and the SCR is turned ON. This causes current to flow in D_8 . This current is sent to the relay driver circuit as a command. Moreover, at this time Q_8 is also turned ON and the base voltage of Q_9 increases and Q_9 is turned OFF. This causes the power amplifier to be placed in the cutoff state, almost no current flows in the power transistors and the excessive calorific value is reduced.

Once turned ON, the SCR remains ON as long as the current does not fall below the holding current. Therefore, once this detector circuit has been operated, the output circuit remains open and the power amplifier remains in the cutoff state even if the temperature of the heat sink falls below the specified temperature. The power must be turned OFF to reset the detector circuit.

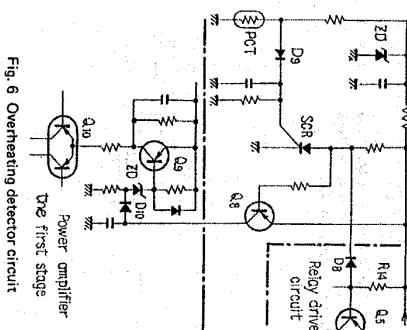


Fig. 6 Overheating detector circuit

4.3 POWER SUPPLY CIRCUIT

Two power transformers are used, and the power amplifier power supplies are independent for the left and right channels. Positive and negative voltages are supplied to the power stage by a bridge rectifier and 33000 μ F (x2) capacitors. Positive and negative voltages are supplied to the drive stage from separate windings (other than those used for the power stage) by a bridge rectifier and plus and minus voltage regulators.

Inrush Current Suppressor Circuit

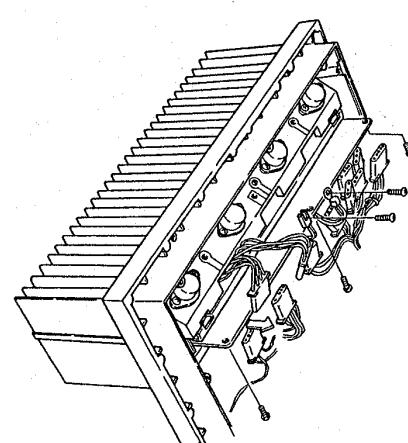
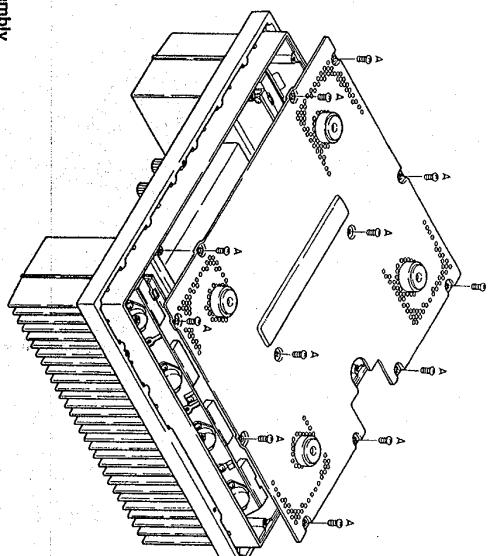
NOTE:
This circuit is only applicable to model (KL-type) having 120V primary voltage.

An extremely large inrush current flows in equipment having two high capacity power supplies, such as this unit, when the power is turned ON. This circuit suppresses this inrush current. Resistor R1 is inserted in series with the primary windings of the power transformers. Since the inrush current flows thru R1 when the power is turned ON, it is suppressed substantially. When C1 is charged thru D1 and R2, the contacts of the relay are closed and R1 is shorted. The time required for this is made sufficiently shorter than the muing time of the output circuit at power ON so that normal operation is not effected.

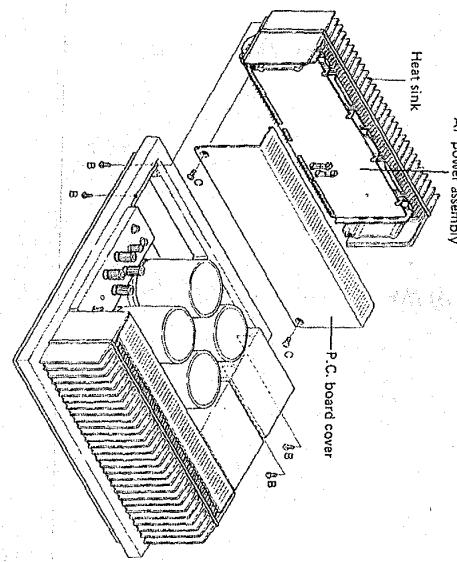
AF Power Assembly
Disconnect the connectors and remove the 5 screws.
Pull off the P.C. board.

5. DISASSEMBLY

Remove the 12 mounting screws(A) at the bottom plate and lift off the bottom plate.

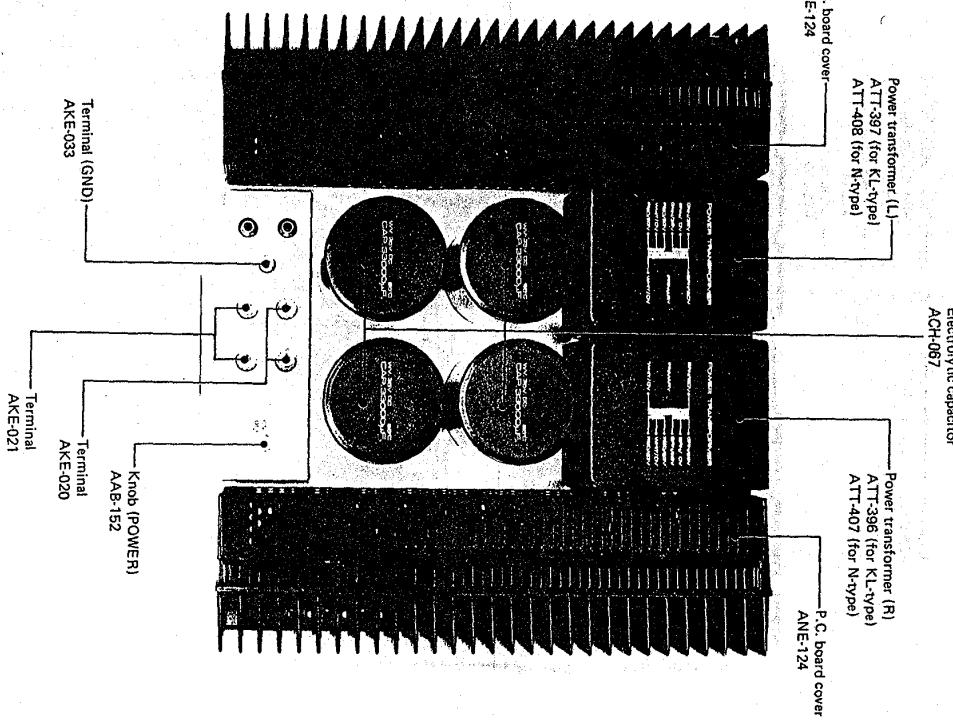


Heat Sink
Remove the 4 screws(B)

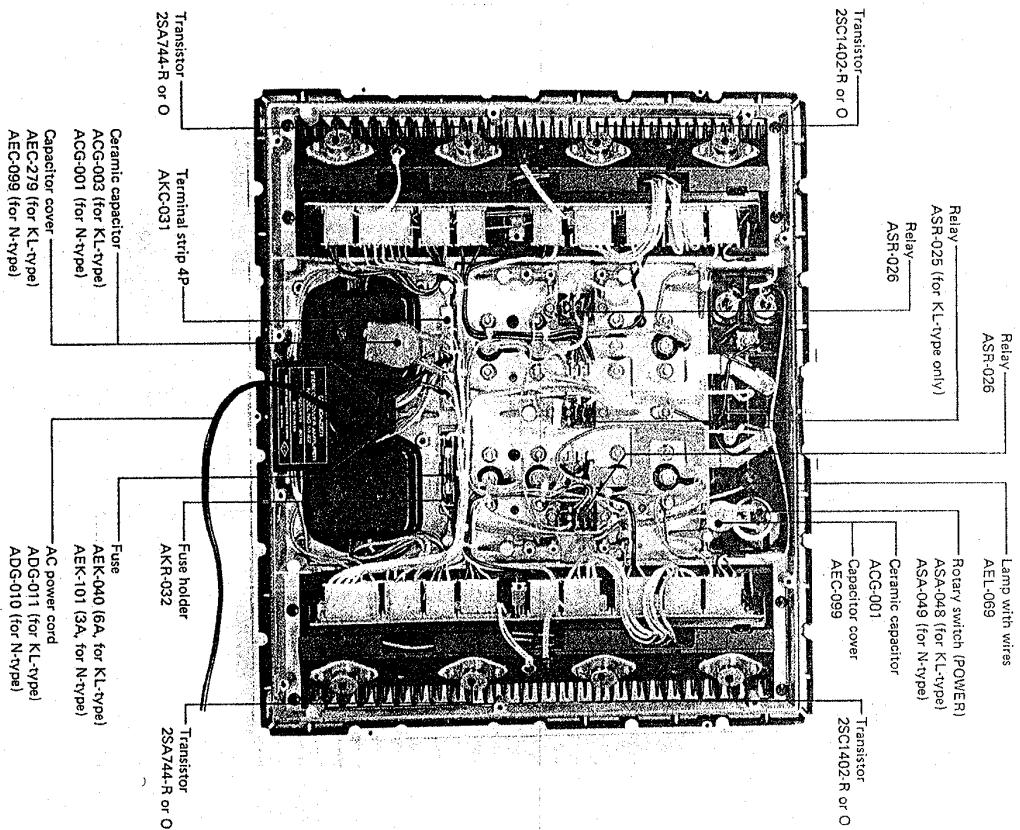


6. PARTS LOCATION

6.1 TOP VIEW



6.2 BOTTOM VIEW



7. ADJUSTMENT

- Open both the input and output terminals.
- Perform the measurement with a DC voltmeter.
- AWK-057 is the left channel printed circuit board and AWK-058 is the right channel printed circuit board.

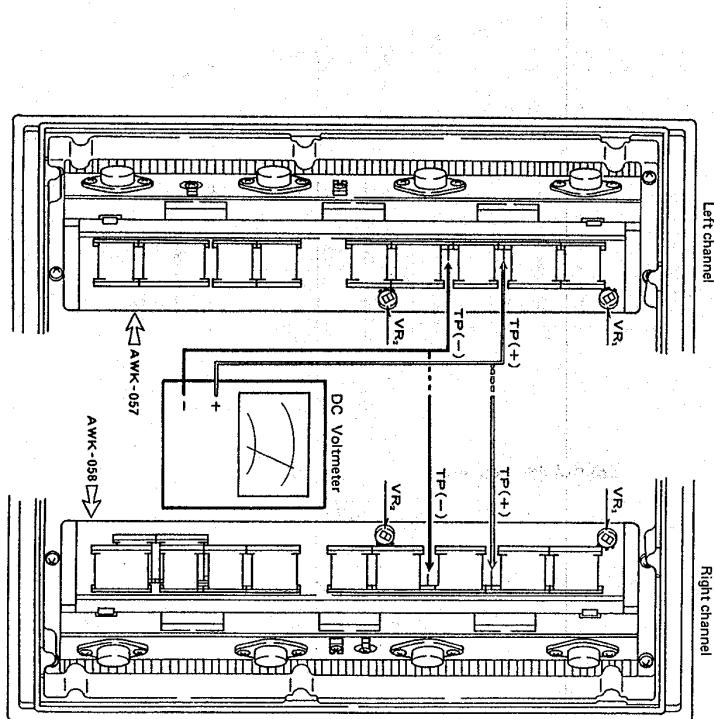
DC Balance Adjustment

Adjust VR1 for +80mV between the (+) and (-) output terminals.

Idle Current Adjustment

Adjust VR2 for 850mV between the TP terminals. Readjust after 10 minutes.

NOTE:
Idle current is 1.7A (0.85A/transistor).

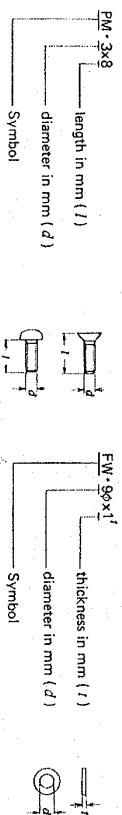


8. EXPLODED VIEW

The following symbols stand for screws, washers and nuts as shown in exploded view.

Symbol	Description	Shape	Symbol	Description	Shape
RT	Brazier head tapping screw		EW	E type washer	
PT	Pan head tapping screw		FW	Flat washer	
BT	Binding head tapping screw		SW	Spring lock washer	
CT	Countersunk head tapping screw		N	Nut	
TT	Truss head tapping screw		WN	Washer faced nut	
OCT	Oval countersunk head tapping screw		ITW	Internal toothed lock washer	
PM	Pan head machine screw		OTW	Outer toothed lock washer	
CM	Countersunk head machine screw		SC	Slotted set screw (Cone point)	
OCM	Oval countersunk head machine screw		SF	Slotted set screw (Flat point)	
TM	Truss head machine screw		HS	Hexagon socket headless set screw	
BM	Binding head machine screw		OCW	Oval countersunk head wood screw	
PSA	Pan head screw with spring lock washer		CW	Countersunk head wood screw	
PSB	Pan head screw with spring lock washer and flat washer		RW	Round head wood screw	
PSF	Pan head screw with flat washer				

EXAMPLE



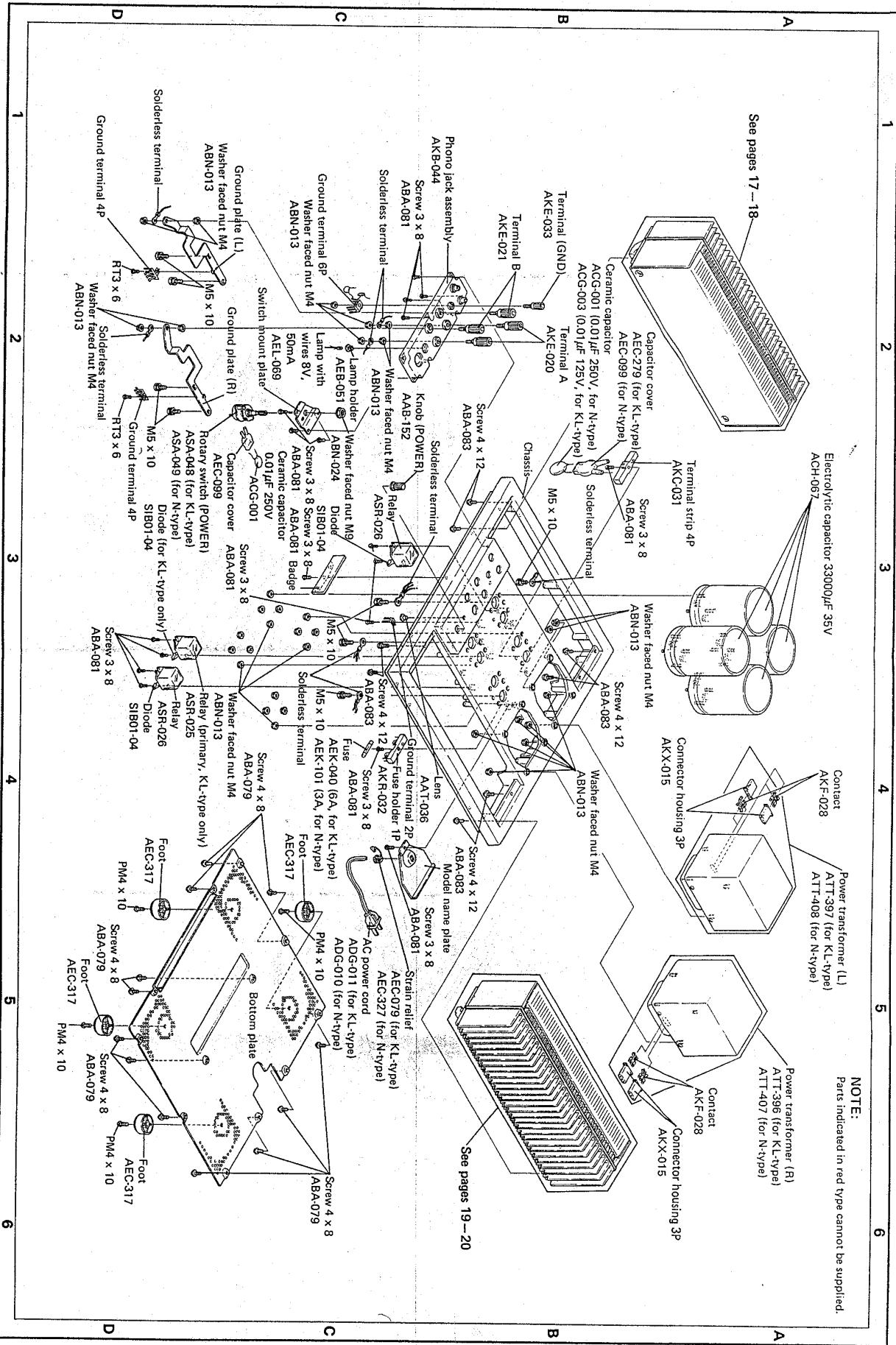
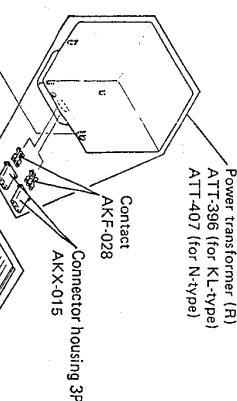
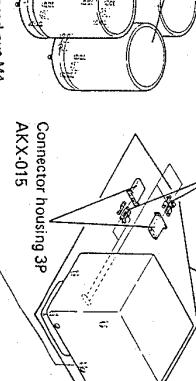
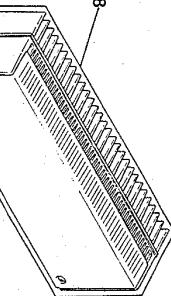
Parts indicated in red type cannot be supplied

Parts indicated in red type cannot be supplied.

Electrolytic capacitor 33000 μ F 35V
ACH-067

Contact
AKF-028

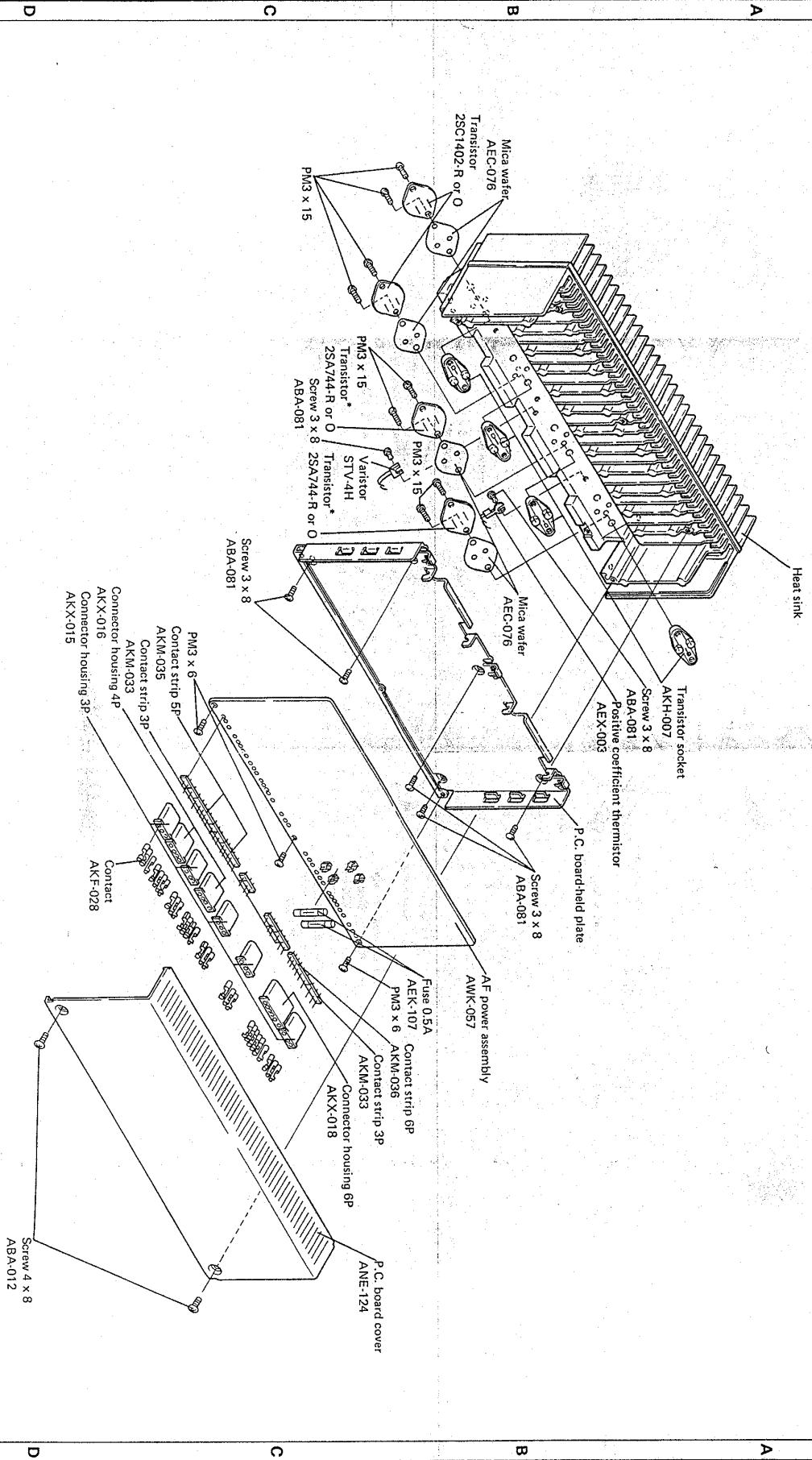
Power transformer (L)
ATT-397 (for KL-type)
ATT-408 (for N-type)

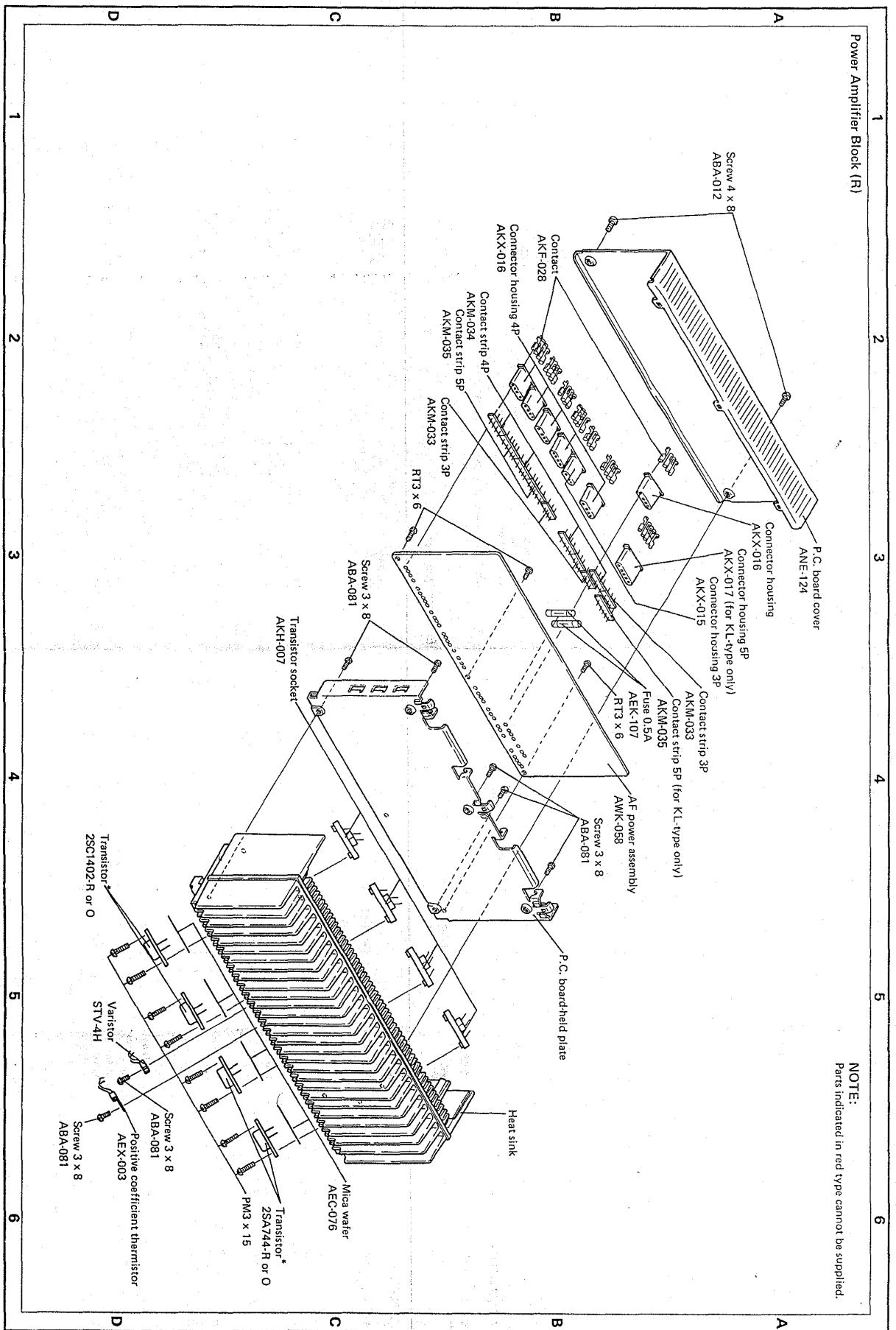


Power Amplifier Block (L)

NOTE

Parts indicated in red type cannot be supplied.





9. SCHEMATIC DIAGRAMS, P. C. BOARD PATTERNS AND PARTS LIST

9.1 MISCELLANEOUS

Miscellaneous Parts

NOTE:

- Capacitors: in μF unless otherwise noted p.p.F
- Resistors: in Ω , $\frac{1}{2}\text{W}$ unless otherwise noted $k, k\Omega, M, M\Omega$

FUSE

<u>Symbol</u>	<u>Description</u>	<u>Part No. (KL-type)</u>	<u>Part No. (N-type)</u>	<u>Remarks</u>
FU1	Fuse 6A	AEK-040	AEK-101	PL-1
FU3	Fuse 3A	.....	.....	S1
FU2	Fuse 0.5A	AEK-107	AEK-107	RL1
FU4	Fuse 0.5A	AEK-107	AEK-107	RL2
FU5	Fuse 0.5A	AEK-107	AEK-107	RL3

TRANSFORMERS

<u>Symbol</u>	<u>Description</u>	<u>Part No. (KL-type)</u>	<u>Part No. (N-type)</u>
T1	Power transformer	ATT-396	ATT-407
T2	Power transformer	ATT-397	ATT-408

CAPACITORS

<u>Symbol</u>	<u>Description</u>	<u>Part No. (KL-type)</u>	<u>Part No. (N-type)</u>	<u>Remarks</u>
C1	Ceramic	0.01	250V	ACG-001
C2	Ceramic	0.01	250V	ACG-001
C3	Ceramic	0.01	250V	ACG-001
C4	Ceramic	0.01	250V	ACG-001
C5	Ceramic	0.01	250V	ACG-001
C6	Ceramic	0.01	125V	ACG-003
		
			.....	ACG-001

SEMICONDUCTORS

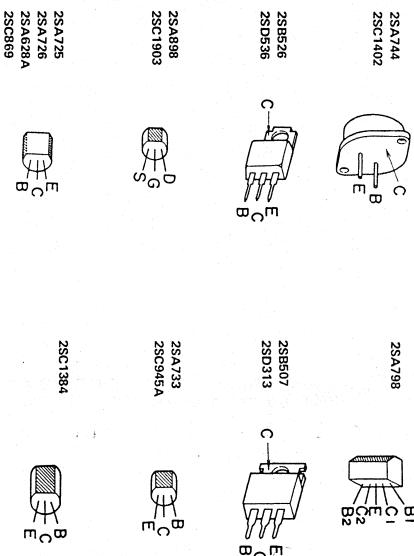
<u>Symbol</u>	<u>Description</u>	<u>Part No.</u>	<u>Part No.</u>	<u>Remarks</u>
Q1	Transistor	2SC1402-R or O	2SC1402-R or O	2SA744-R or O
Q2	Transistor	2SC1402-R or O	2SC1402-R or O	2SA744-R or O
Q3	Transistor	2SC1402-R or O	2SC1402-R or O	2SA744-R or O
Q4	Transistor	2SC1402-R or O	2SC1402-R or O	2SA744-R or O
Q5	Transistor	2SC1402-R or O	2SC1402-R or O	2SA744-R or O
Q6	Transistor	2SC1402-R or O	2SC1402-R or O	2SA744-R or O
Q7	Transistor	2SC1402-R or O	2SC1402-R or O	2SA744-R or O
Q8	Transistor	2SC1402-R or O	2SC1402-R or O	2SA744-R or O
	
	
	
	
D1	Diode	SIB01-04	SIB01-04	.....
D2	Diode	SIB01-04	SIB01-04	.....
D3	Diode	SIB01-04	SIB01-04	.....

* Note: These transistors (Q1-Q8) should have the same value (matched pair).

OTHERS

<u>Symbol</u>	<u>Description</u>	<u>Part No. (KL-type)</u>	<u>Part No. (N-type)</u>	<u>Remarks</u>
R1	Carbon film resistor 2.2k $\frac{1}{2}\text{W}$	RD2%	RD2%	RD2%FS 222J
	

External Appearances of Transistors



KL-type only

<u>Symbol</u>	<u>Description</u>	<u>Part No.</u>	<u>Symbol</u>	<u>Description</u>	<u>Part No.</u>
D7	Diode	1S2473 (1S1555)	D36	Diode	1S2473 (1S1555)
D8	Varistor	STV-4H	D37	Diode	1S2473 (1S1555)
D9	Diode	1S2473 (1S1555)	D38	Diode	1S2473 (1S1555)
D10	Diode	SR3AM-8			
D11	Diode	SR3AM-8			
D12	Diode	10E2 (1S1885)			
D13	Diode	10E2 (1S1885)			
D14	Diode	10E2 (1S1885)			
D15	Diode	10E2 (1S1885)			
D16	Zener diode	WZ-240			
D17	Zener diode	WZ-130			
D18	Diode	1S2473 (1S1555)			
D19	Diode	1S2473 (1S1555)			
D20	Diode	1S2473 (1S1555)			
D21	Diode	1S2473 (1S1555)			
D21	Diode	1S2473 (1S1555)			
D23	Diode	1S2473 (1S1555)			
D24	Diode	1S2473 (1S1555)			
D25	Diode	1S2473 (1S1555)			
D26	Zener diode	WZ-130			
D27	Diode	1S2473 (1S1555)			
D28	Diode	1S2473 (1S1555)			
D29	SCR	CR02AM-2			
D30	Diode	1S2473 (1S1555)			
D31	Diode	1S2473 (1S1555)			
D32	Diode	1S2473 (1S1555)			
D33	Diode	1S2473 (1S1555)			
D34	Diode	1S2473 (1S1555)			
D35	Diode	1S2473 (1S1555)			

1

2

3

AF Power Assembly (AWK-057)

A

A

B

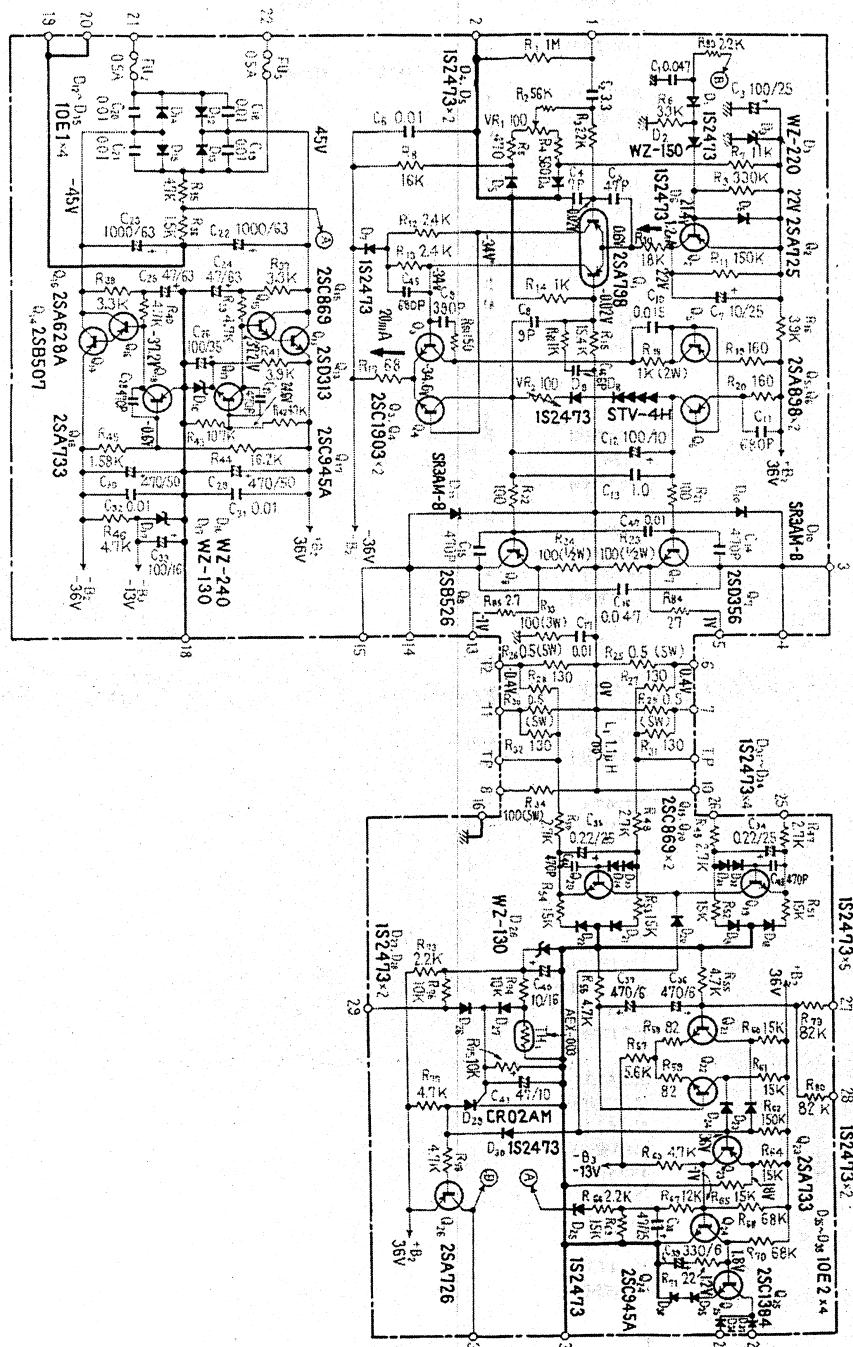
B

C

C

D

D



1

2

3

9.2 SCHEMATIC DIAGRAM FOR KL-TYPE

1 2 3 4 5 6

NOTE:
The indicated semiconductors are representative ones only. Other
alternative semiconductors may be used and are listed in the parts
list.

NOTES:

S1:

POWER

SWITCH

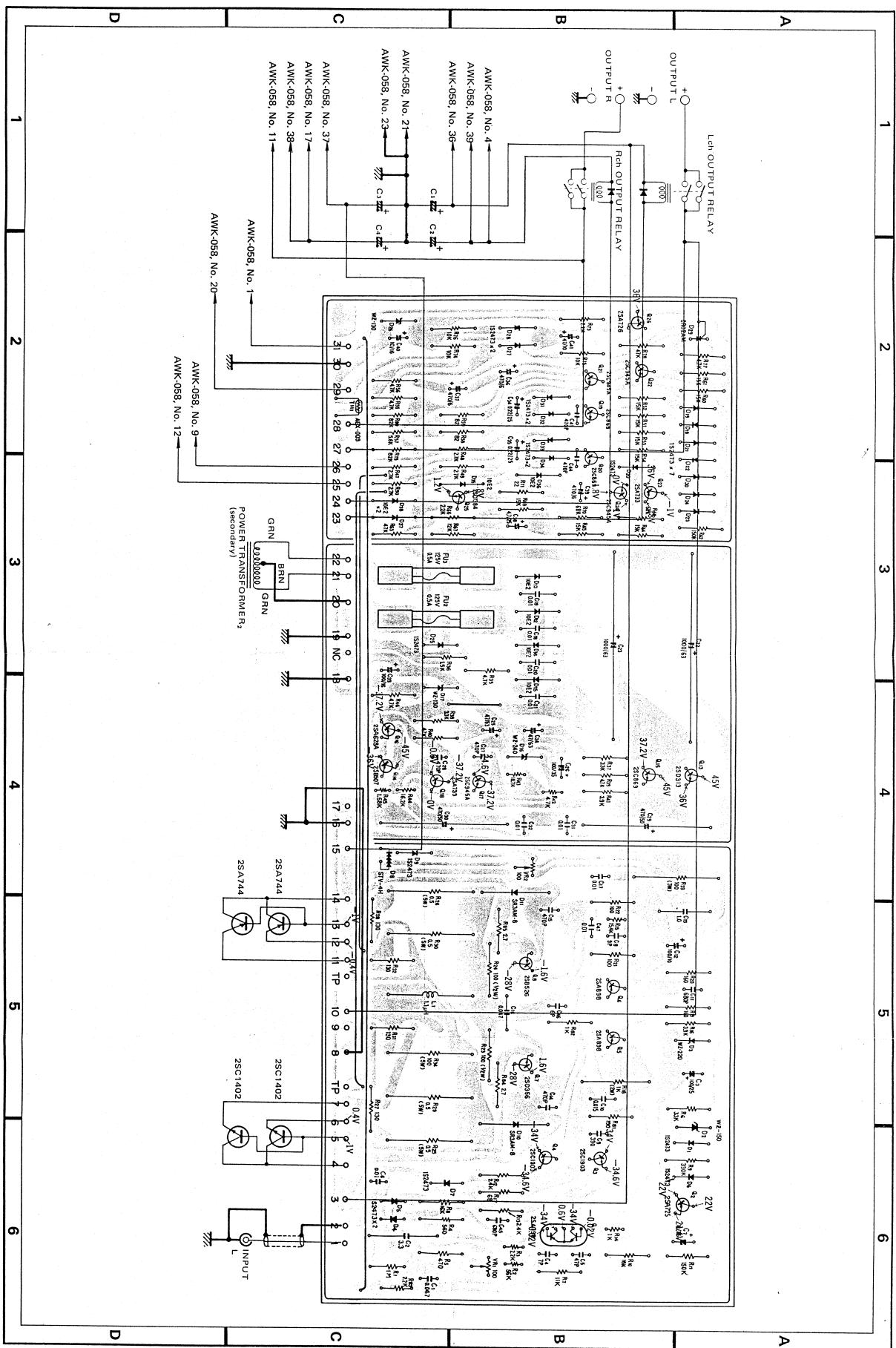
OFF

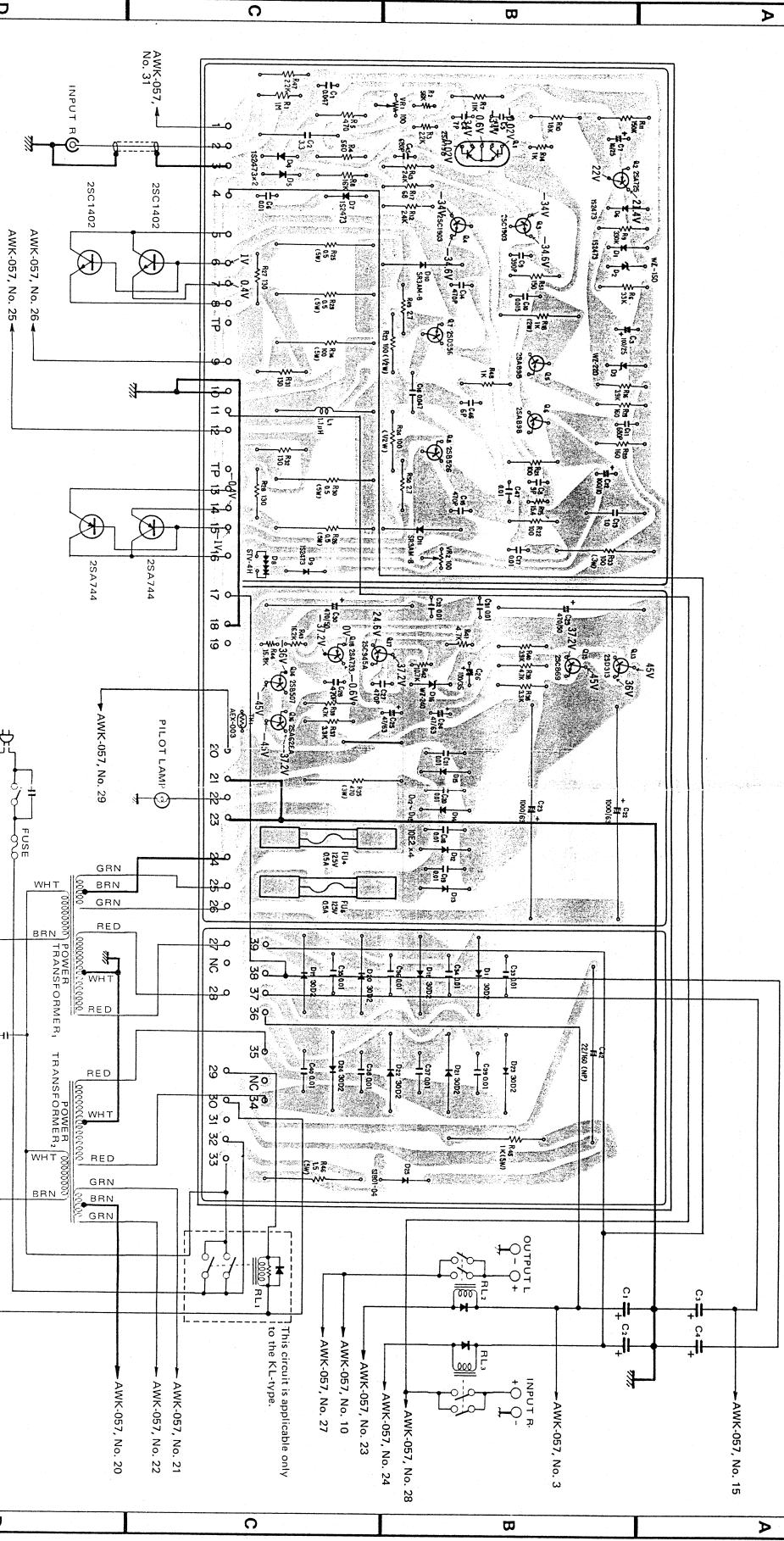
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ON

9.4 AF POWER ASSEMBLY (AWK-057)

OTHERS											
Symbol	Description	Part No.	Symbol	Description	Part No.	Symbol	Description	Part No.	Symbol	Description	
L ₁	AF choke coil 1.1μH	AFC-012	C41	Electrolytic 47	10V	CFA-470P-16		R31	Carbon film 130	RD42PS 131J	
	Fuse clip	AFC-013	C42	Vacancy 470p	10V			R32	Carbon film 130	RD42PS 131J	
	Contact strip 3P	AKM-033	C43	Ceramic 470p	50V	CKDYF 471K-50		R33	Metal oxide 100	RSP-101J	
	Contact strip 5P	AKM-035	C44	Ceramic 470p	50V	CKDYB 471K-50		R34	Carbon film 100	R15B-10K	
	Contact strip 6P	AKM-036	C45	Ceramic 680p	50V	CKDYB 581K-50		R35	Carbon film 47k	RD42PS 472J	
	Heat sink (small) sponge	ANH-317	C46	Ceramic 6p	50V	CKDYF 660F-50		R36	Carbon film 1.5k	RD42PS 152J	
		AEC-387	C47	Mylar 0.01	50V	CKDYA 660F-50		R37	Carbon film 33k	RD42PS 333J	
						CKDYB 660F-50		R38	Carbon film 33k	RD42PS 333J	
						CKDYB 581K-50		R39	Carbon film 47k	RD42PS 472J	
								R40	Carbon film 47k	RD42PS 472J	
								R41	Carbon film 3.9k	RD42PS 392J	
								R42	Carbon film 4.7k	RD42PS 471F	
								R43	Metall film 10.7k	RN175SQ 1072F	
								R44	Metall film 16.2k	RN175SQ 1622F	
								R45	Metall film 15.8k	RN175SQ 1522F	
								R46	Carbon film 4.7k	RD42PS 472J	
								R47	Carbon film 2.7k	RD42PS 272J	
								R48	Carbon film 2.7k	RD42PS 272J	
								R49	Carbon film 2.7k	RD42PS 272J	
								R50	Carbon film 15.2k	RD42PS 152J	
								R51	Carbon film 15k	RD42PS 152J	
								R52	Carbon film 15k	RD42PS 152J	
								R53	Carbon film 15k	RD42PS 152J	
								R54	Carbon film 15k	RD42PS 152J	
								R55	Carbon film 4.7k	RD42PS 472J	
								R56	Carbon film 4.7k	RD42PS 472J	
								R57	Carbon film 5.6k	RD42PS 472J	
								R58	Carbon film 8.2k	RD42PS 820J	
								R59	Carbon film 82	RD42PS 820J	
								R60	Carbon film 15k	RD42PS 152J	
								R61	Carbon film 15k	RD42PS 152J	
								R62	Carbon film 150k	RD42PS 152J	
								R63	Carbon film 4.7k	RD42PS 472J	
								R64	Carbon film 15k	RD42PS 152J	
								R65	Carbon film 15k	RD42PS 152J	
								R66	Carbon film 15k	RD42PS 152J	
								R67	Carbon film 12k	RD42PS 123J	
								R68	Carbon film 68k	RD42PS 683J	
								R69	Carbon film 15k	RD42PS 152J	
								R70	Carbon film 68k	RD42PS 683J	
								R71	Carbon film 22	TH-1	
								R72	Carbon film 2.2k	RD42PS 222J	
								R73	Carbon film 10k	RD42PS 222J	
								R74	Carbon film 10k	RD42PS 103J	
								R75	Carbon film 10k	RD42PS 103J	
								R76	Carbon film 4.7k	RD42PS 472J	
								R77	Carbon film 4.7k	RD42PS 472J	
								R78	Carbon film 4.7k	RD42PS 472J	
								R79	Carbon film 82k	RD42PS 823J	
								R80	Carbon film 82k	RD42PS 823J	
								D6	Diode		

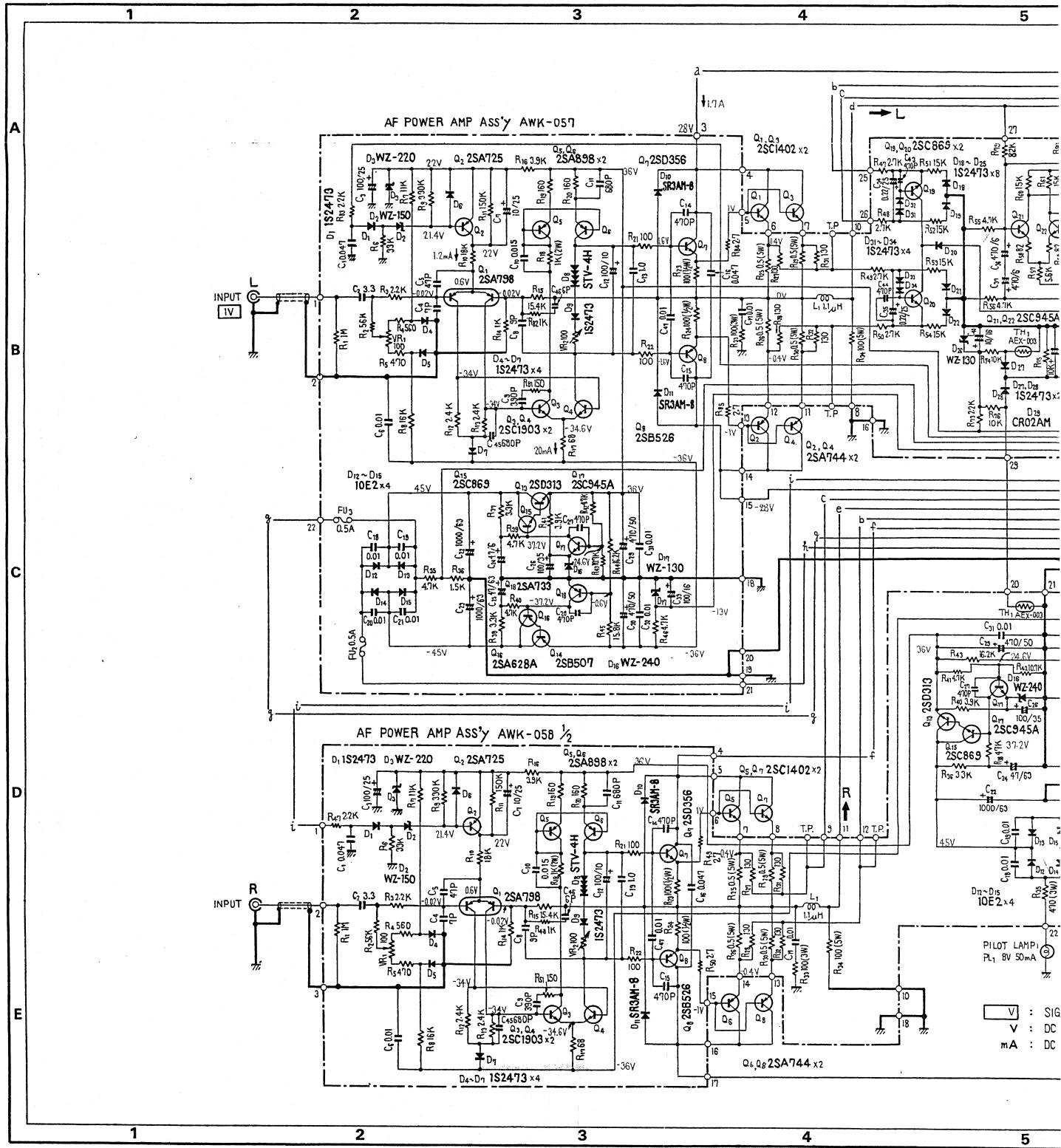


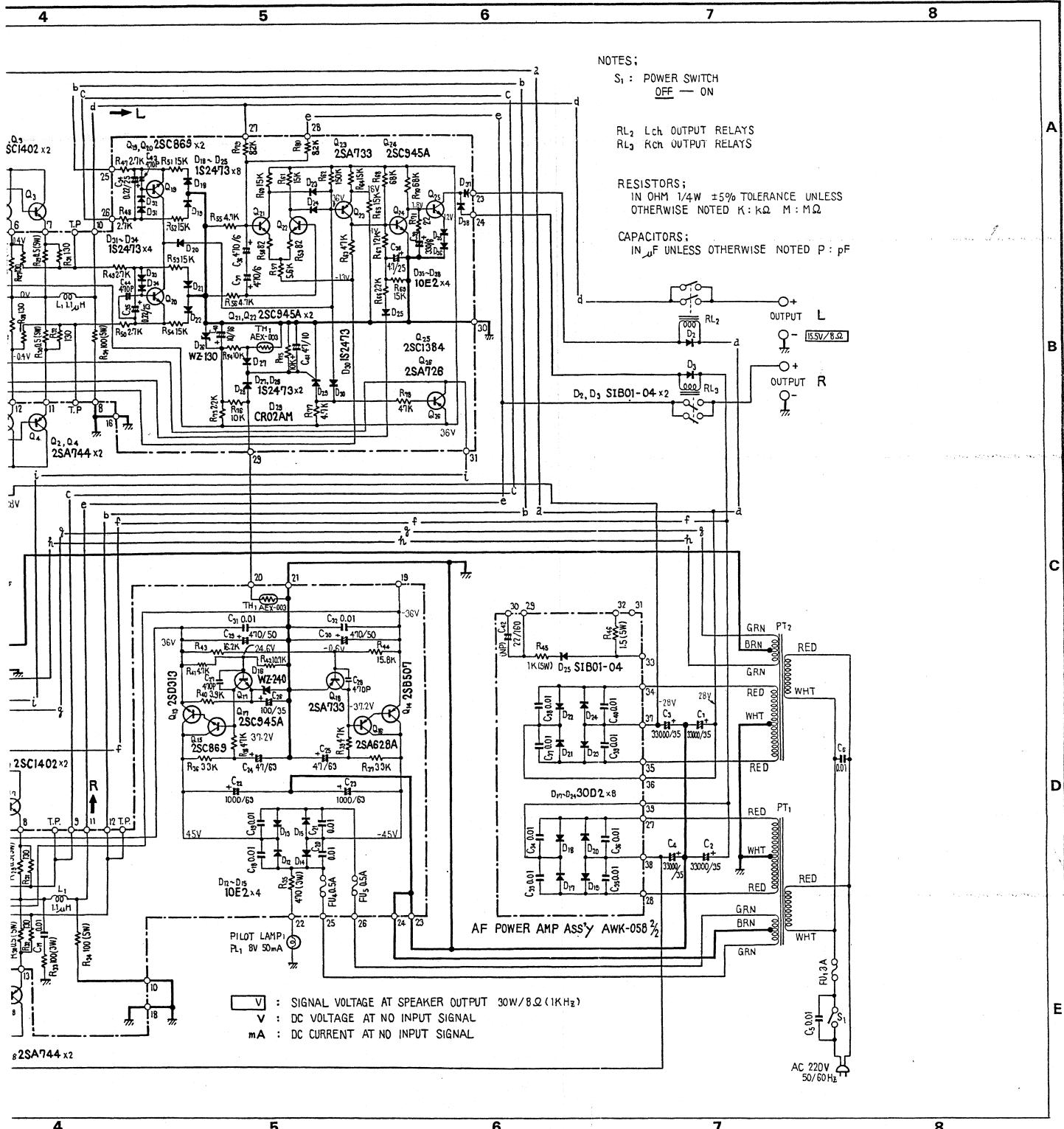


STEREO POWER AMPLIFIER

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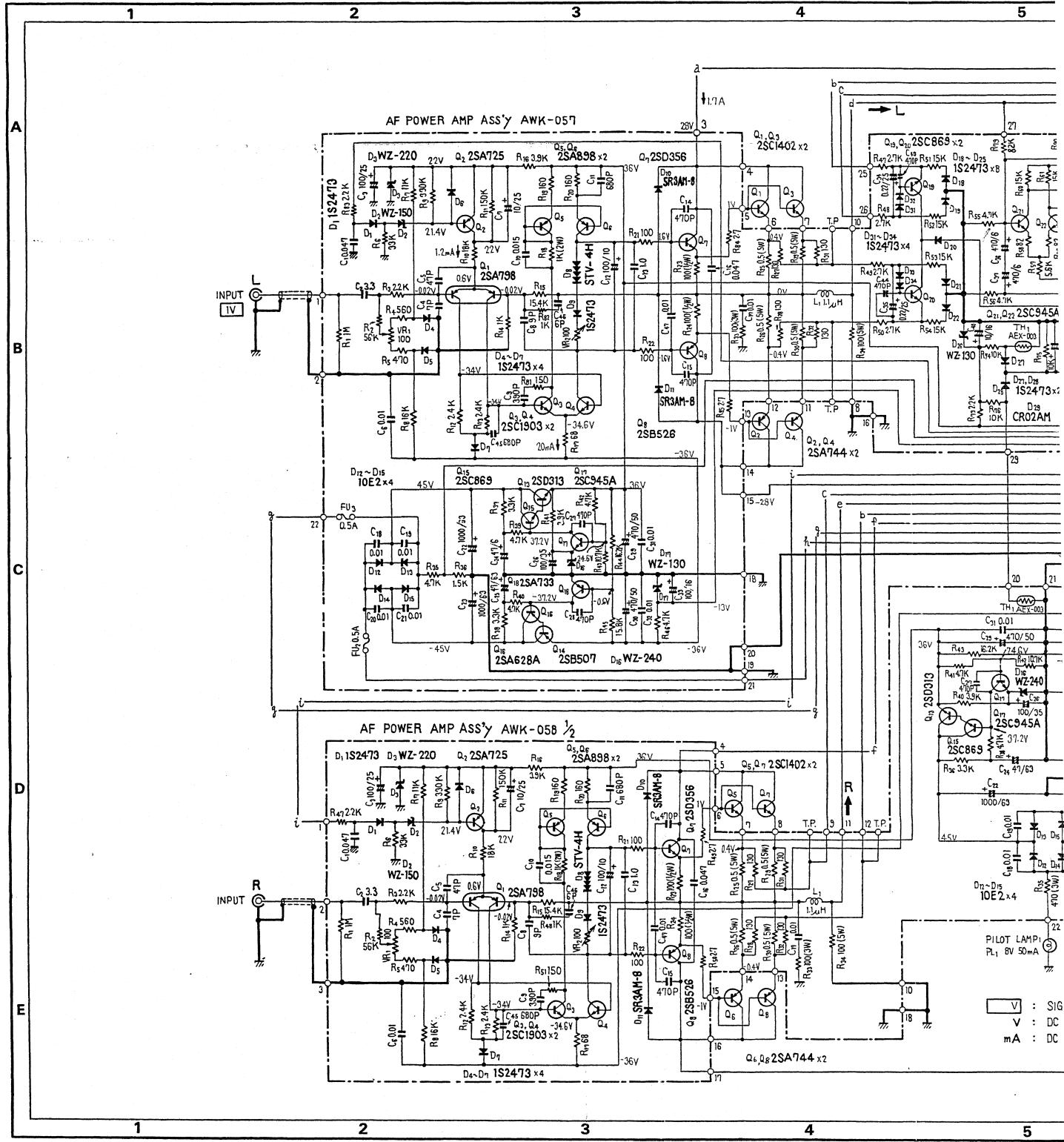




STEREO POWER AMPLIFIER

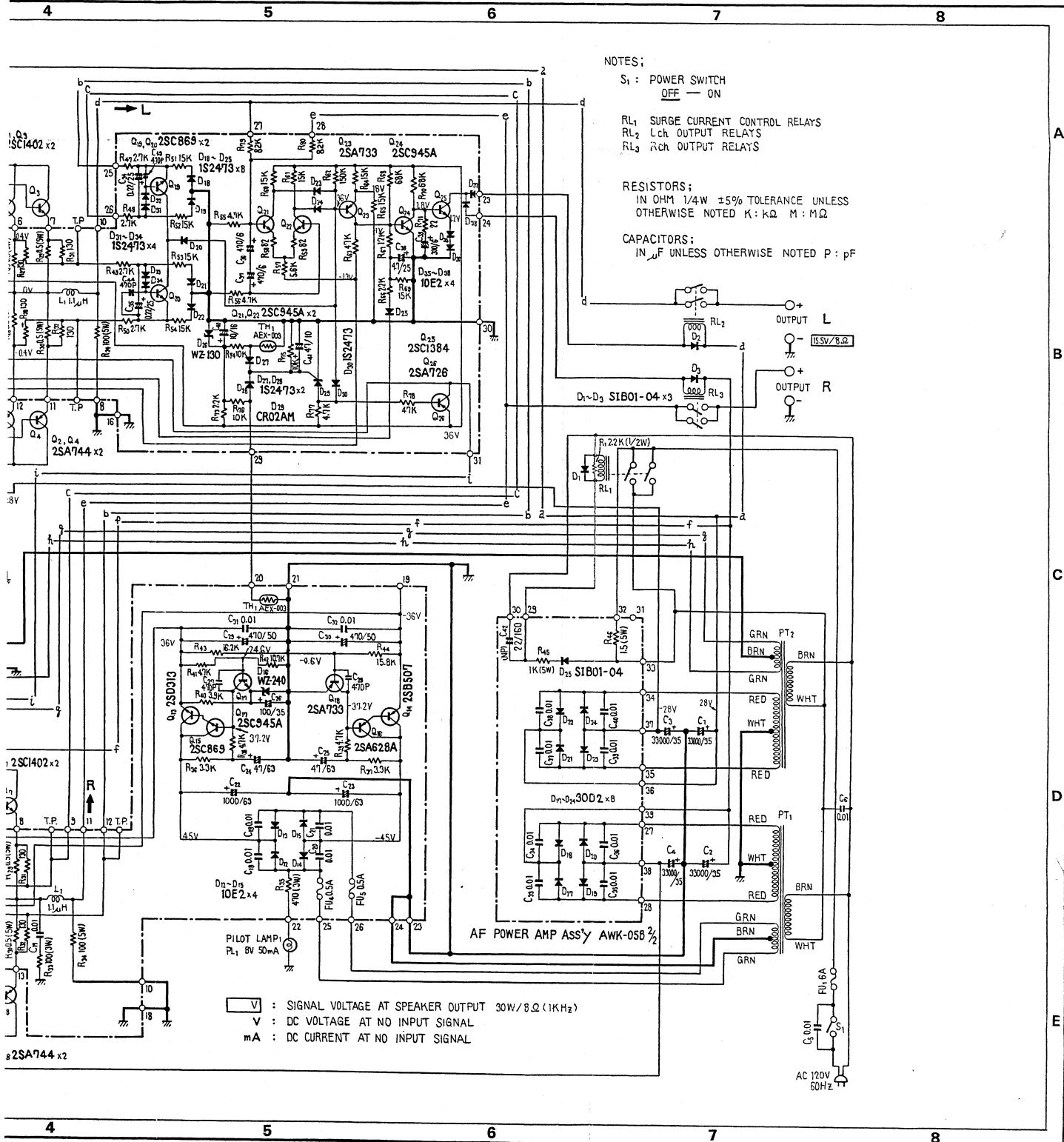
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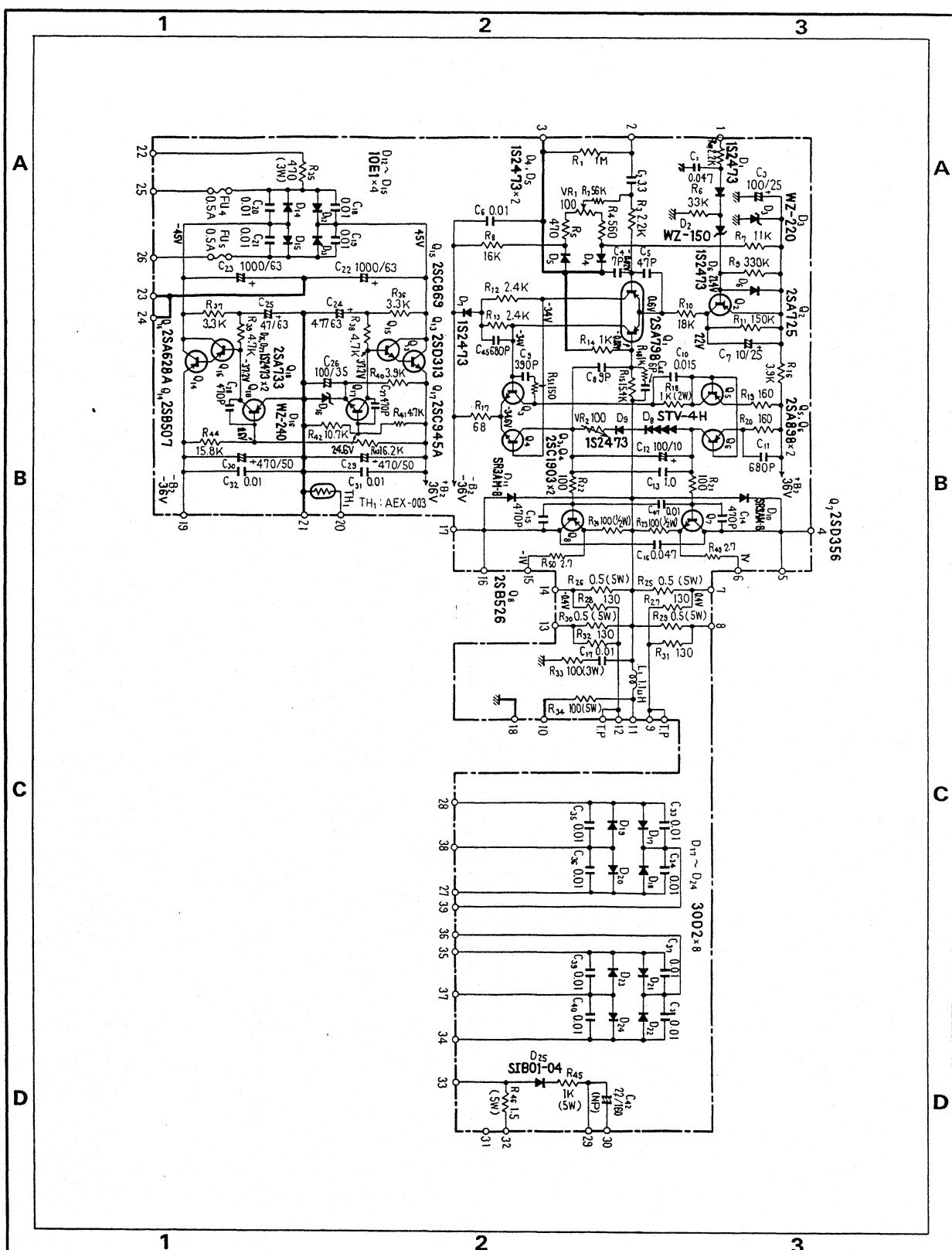


V : SIG
V : DC
mA : DC

 PIONEER



8 2SA744 x2



Parts List of AF Power Assembly (AWK-058)

OTHERS

<u>Symbol</u>	<u>Description</u>	<u>Part No.</u>	<u>Symbol</u>	<u>Description</u>	<u>Part No.</u>
L1	AF choke coil 1.1μH	ATH-012	C41	Vacancy	.....
	Fuse clip	AKR-013	C42	Electrolytic (NP) 22	160V
	Contact strip 3P	AKM-033	C43	Vacancy	.....
	Contact strip 4P	AKM-034	C44	Vacancy	.....
	Contact strip 5P	AKM-035	C45	Ceramic	680p 50V
	Heat sink (small)	ANH-317	C46	Ceramic	6p 50V
	Sponge	AEC-387	C47	Mylar	0.01 50V

CAPACITORS

<u>Symbol</u>	<u>Description</u>	<u>Part No.</u>	<u>Symbol</u>	<u>Description</u>	<u>Part No.</u>
C1	Mylar 0.047	50V CQMA 473J 50	RESISTORS		
C2	Metallized mylar 3.3	100V ACE-013	VR1	Semi-fixed 100-B	ACP-032
C3	Electrolytic 100	25V CEA 101P 25	VR2	Semi-fixed 100-B	ACP-032
C4	Ceramic 7p	50V CCDSL 070F 50	R1	Metal film 1M	RN1/PT 1004G
C5	Ceramic 47p	50V CCDSL 470K 50	R2	Metal film 56k	RN1/5SQ 5602F
C6	Ceramic 0.01	50V CKDYF 103Z 50	R3	Metal film 2.2k	RN1/5SQ 2201F
C7	Electrolytic 10	25V CEA 100P 25	R4	Carbon film 560	RD1/PS 561J
C8	Ceramic 9p	50V CCDSL 090F 50	R5	Carbon film 470	RD1/PS 471J
C9	Ceramic 390p	50V CCDSL 391J 50	R6	Carbon film 33k	RD1/PS 333J
C10	Mylar 0.015	50V CQMA 153J 50	R7	Carbon film 11k	RD1/PS 113J
C11	Ceramic 680p	50V CKDYB 681K 50	R8	Carbon film 16k	RD1/PS 163J
C12	Electrolytic 100	10V CEA 101P 10	R9	Carbon film 330k	RD1/PS 334J
C13	Metallized mylar 1	100V ACE-008	R10	Carbon film 18k	RD1/PS 183J
C14	Ceramic 470p	50V CKDYB 471K 50	R11	Carbon film 150k	RD1/PS 154J
C15	Ceramic 470p	50V CKDYB 471K 50	R12	Carbon film 2.4k	RD1/PS 242J
C16	Mylar 0.047	100V CQMA 473J 100	R13	Carbon film 2.4k	RD1/PS 242J
C17	Mylar 0.01	50V CQMA 103J 50	R14	Metal film 1k	1/5W RN1/5SQ 1001F
C18	Ceramic 0.01	150V ACG-004	R15	Metal film 15.4k	1/5W RN1/5SQ 1542F
C19	Ceramic 0.01	150V ACG-004	R16	Carbon film 3.9k	RD1/PS 392J
C20	Ceramic 0.01	150V ACG-004	R17	Carbon film 68	RD1/PS 680J
C21	Ceramic 0.01	150V ACG-004	R18	Metal oxide 1k	2W RS2P 102J
C22	Electrolytic 1000	63V ACH-319	R19	Carbon film 160	RD1/PS 161J
C23	Electrolytic 1000	63V ACH-319	R20	Carbon film 160	RD1/PS 161J
C24	Electrolytic 47	63V CEA 470P 63	R21	Carbon film 100	RD1/PS 101J
C25	Electrolytic 47	63V CEA 470P 63	R22	Carbon film 100	RD1/PS 101J
C26	Electrolytic 100	35V CEA 101P 35	R23	Carbon film 100	1/5W RD1/PSF 101J
C27	Ceramic 470p	50V CKDYB 471K 50	R24	Carbon film 100	1/5W RD1/PSF 101J
C28	Ceramic 470p	50V CKDYB 471K 50	R25	Wire wound 0.5	5W RT5B 0R5K
C29	Electrolytic 470	50V CEB 471P 50	R26	Wire wound 0.5	5W RT5B 0R5K
C30	Electrolytic 470	50V CEB 471P 50	R27	Carbon film 130	RD1/PS 131J
C31	Ceramic 0.01	50V CKDYF 103Z 50	R28	Carbon film 130	RD1/PS 131J
C32	Ceramic 0.01	50V CKDYF 103Z 50	R29	Wire wound 0.5	5W RT5B 0R5K
C33	Ceramic 0.01	150V ACG-004	R30	Wire wound 0.5	5W RT5B 0R5K
C34	Ceramic 0.01	150V ACG-004	R31	Carbon film 130	RD1/PS 131J
C35	Ceramic 0.01	150V ACG-004	R32	Carbon film 130	RD1/PS 131J
C36	Ceramic 0.01	150V ACG-004	R33	Metal oxide 100	3W RS3P 101J
C37	Ceramic 0.01	150V ACG-004	R34	Wire wound 100	5W RT5B 101K
C38	Ceramic 0.01	150V ACG-004	R35	Metal oxide 470	3W RS3P 471J

<u>Symbol</u>	<u>Description</u>		<u>Part No.</u>	<u>Symbol</u>	<u>Description</u>		<u>Part No.</u>
R36	Carbon film	33k	RD%PS 333J	D7	Diode		1S2473
R37	Carbon film	33k	RD%PS 333J				(1S1555)
R38	Carbon film	47k	RD%PS 473J	D8	Varistor		STV-4H
R39	Carbon film	47k	RD%PS 473J	D9	Diode		1S2473
R40	Carbon film	3.9k	RD%PS 392J				(1S1555)
R41	Metal film	4.7k	1/5W	RN1/5SQ 4701F	D10	Diode	
R42	Metal film	10.7k	1/5W	RN1/5SQ 1072F	D11	Diode	SR3AM-8
R43	Metal film	16.2k	1/5W	RN1/5SQ 1622F	D12	Diode	SR3AM-8
R44	Metal film	15.8k	1/5W	RN1/5SQ 1582F			10E2
R45	Wire wound	1k	5W	RT5B 102K	D13	Diode	(1S1885)
R46	Wire wound	1.5	5W	RT5B 1R5K			10E2
R47	Carbon film	2.2k		RD%PS 222J	D14	Diode	(1S1885)
R48	Carbon film	1k		RD%PS 102J	D15	Diode	10E2
R49	Carbon film	2.7		RD%PS 2R7J			(1S1885)
R50	Carbon film	2.7		RD%PS 2R7J	D16	Zener diode	WZ-240
R51	Carbon film	150		RD%PS 151J	D17	Diode	
SEMICONDUCTORS				D18	Diode		30D2 (SR3AM-4)
<u>Symbol</u>	<u>Description</u>		<u>Part No.</u>				30D2 (SR3AM-4)
Q1	Transistor		2SA798-F or G	D19	Diode		30D2
Q2	Transistor		2SA725-F or G	D20	Diode		(SR3AM-4)
Q3	Transistor		2SC1903-B or V				30D2
Q4	Transistor		2SC1903-B or V				(SR3AM-4)
Q5	Transistor		2SA898-B or V	D21	Diode		30D2
Q6	Transistor		2SA898-B or V				(SR3AM-4)
Q7*	Transistor		2SD356-D or C	D22	Diode		30D2
Q8*	Transistor		2SB526-D or C				(SR3AM-4)
* hfe of Q7 and Q8 should have the same value (matched pair).				D23	Diode		30D2
Q13	Transistor		2SD313-D or E	D24	Diode		(SR3AM-4)
Q14	Transistor		2SB507-D or E				30D2
Q15	Transistor		2SC869-D or C	D25	Diode		(SR3AM-4)
Q16	Transistor		2SA628A-D or C				SIB01-04
Q17	Transistor		2SC945A-P or Q (2SC1647-P or Q)				
Q18	Transistor		2SA733-R or Q (2SA823-P or Q)				
TH1	Positive coefficient thermistor		AEX-003				
D1	Diode		1S2473 (1S1555)				
D2	Zener diode		WZ-150				
D3	Zener diode		WZ-220				
D4	Diode		1S2473 (1S1555)				
D5	Diode		1S2473 (1S1555)				
D6	Diode		1S2473 (1S1555)				

10. PACKING

