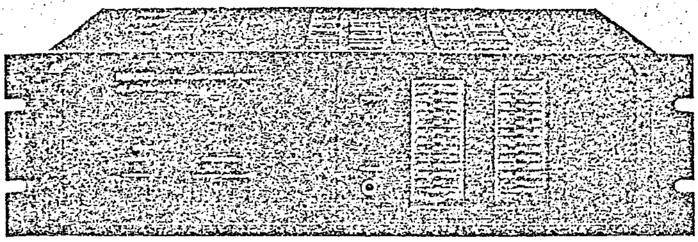
NIKKO POWER AMP

ALPHA 220

STEREO POWER AMPLIFIER



TYPE AND VOLTAGE

W-TYPE:	UL and CSA type	120V AC
E -TYPE:	NK-STD type	220V AC
B -TYPE:	BS type	240V AC

SERVICE MANUAL

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SPECIFICATIONS

AMPLIFIER SECTION

Continuous Power Output per Channel:

20 ~ 20000 Hz (8 ohms)	more than 120 Watts
20 ~ 20000 Hz (4 ohms)	more than 130 Watts
1000 Hz (8 ohms)	more than 120 Watts
1000 Hz (4 ohms)	more than 130 Watts

T. H. Distortion, 8 ohms:

at Continuous Power Output	no more than 0.008%
at 1 Watt Power Output	no more than 0.02%

T. H. Distortion, 4 ohms:

at Continuous Power Output	no more than 0.02%

I. M. Distortion, 8 ohms:

at Continuous Power Output	no more than 0.01%
at 1 Watt Power Output	no more than 0.02%

IHF Power Bandwidth, 8 ohms:	5 ~ 70000Hz
Damping Factor at 1000 Hz, 8 ohms:	more than 60

Frequency Response, "NORMAL" input, 8 ohms:

at 1 Watt power Output	10 ~ 100000Hz +0, −1dB

Input Sensitivity for 120 Watts Power Output:

MAIN IN	1V ± 2dB

Signal to Noise Ratio, IHF "A" Network:

MAIN (NORMAL, DIRECT)	better than 105dB

Signal to Noise Ratio, DIN Filter:

MAIN IN (NORMAL, DIRECT)	better than 90dB

Channel Balance:	no more than 1dB
Residual Hum and Noise, 8 ohms:	no more than 0.5mV
Idling Current:	40 ~ 120mA
Midpoint Voltage:	0 ± 20mV
Muting Delay Time:	3 ~ 7 seconds

GENERAL

Power Requirement:

W-TYPE	AC 120V, 60Hz
E-TYPE	AC 220V, 50Hz
B-TYPE	AC 240V, 50Hz

Power Consumption:	480 W (620 VA)
Ambient Temperature during Operation:	−10 ~ 30°C

Dimensions:

Width	482 mm	(19 inches)
Height	138 mm	(5 1/3 inches)
Depth	344 mm	(13 1/2 inches)

Weight, without package:	13.5 kg (29.7 lbs)

*Specifications are subject to change without notice.

BLOCK DIAGRAM

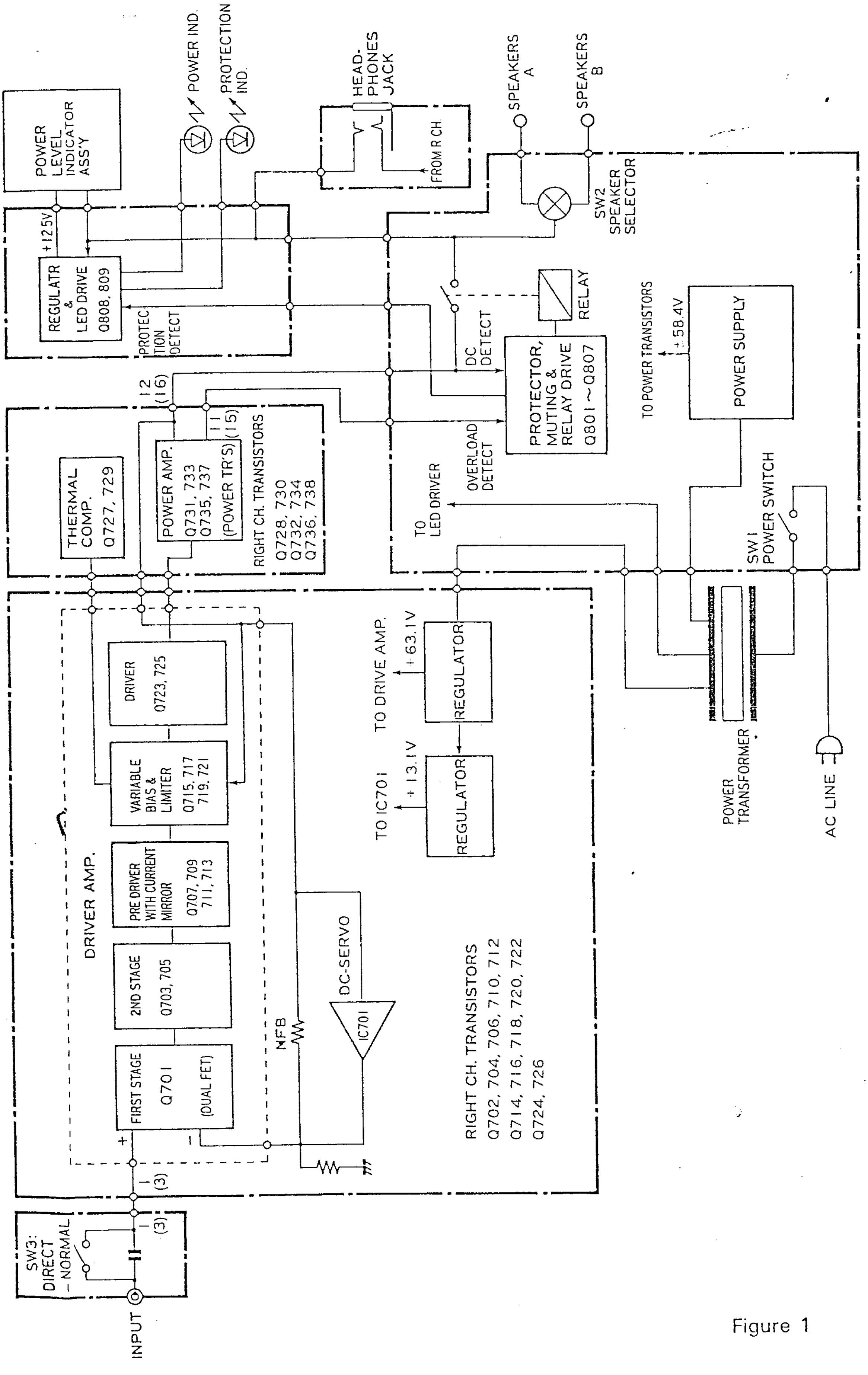


Figure 1

DISASSEMBLY

CABINET COVER REMOVAL

a. Remove four tapping screws from the top of the unit.

b. Remove four screws from both sides of the unit.

c. Lift the cabinet cover away from the unit.

BOTTOM PLATE REMOVAL

a. Remove nine tapping screws from the bottom of the unit as shown in Photo 1. (#1 – #9)

b. Lift the bottom plate away from the unit.

FRONT PANEL REMOVAL

a. Remove three tapping screws (#1 – #3) from the left side of the unit as shown in Photo 2.

b. Similarly remove three tapping screws from the right side of the unit.

c. Remove the front panel away from the unit by pulling it forward.

POWER TRANSFORMER REMOVAL

a. Remove the cabinet cover and the bottom plate.

b. Disconnect all the cables from the power transformer.

c. Remove four nuts (#1 – #4) from the chassis as shown in Photo 3.

d. Lift the power transformer away from the unit.

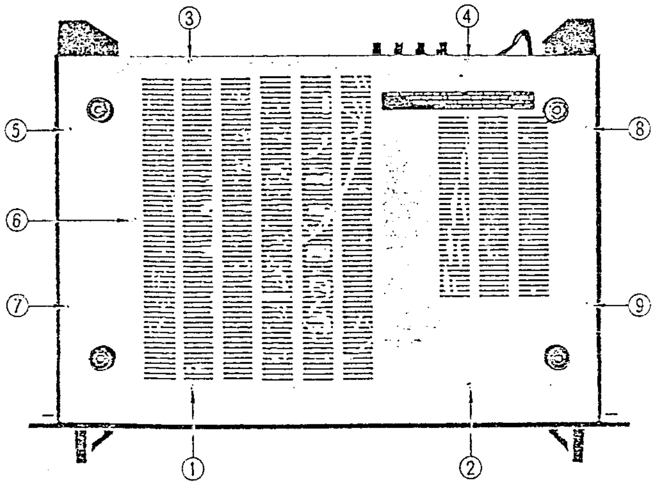


Photo 1

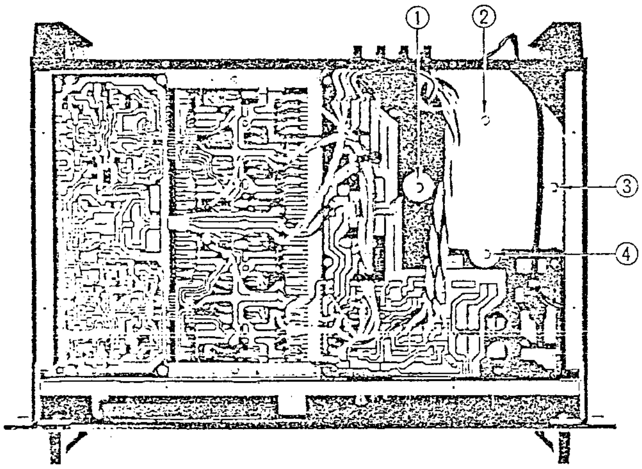


Photo 3

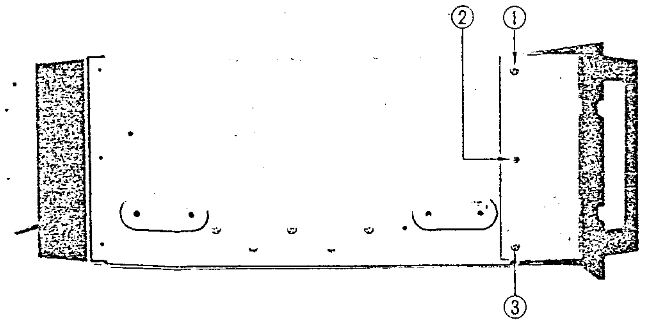


Photo 2

IRCUIT DESCRIPTION

IKKO's ALPHA 220, adopting latest devices such as i-fT power transistors, is of a design introducing a variable ias circuit (non-switching circuit), a DC servo circuit and ther most advanced techniques.

For details, refer to page 2 "BLOCK DIAGRAM" nd page 8 "SCHEMATIC DIAGRAM".

The following are explanations of the main circuits nd devices.

. VARIABLE BIAS CIRCUIT

Currently, in the output stage of power amplifiers are mostly used SEPP (Single Ended Push Pull) circuits. (Fig. 2).
It is generally known that the current (idle current) flowing through NPN and PNP transistors of this circuit can be classified into three large groups of operation form, class "A", class "AB" and class "B". (Fig. 3).
In class "A" operation, neither of collector currents, Q_1 and Q_2, becomes zero nor cut off. Even when the current flowing to the load R_L is zero, a certain current is flowing through Q_1 and Q_2, and so no crossover distortion exists theoretically.
To realize perfect class "A" operation, however, a current equal to or more than maximum output should continue to be let flow at the output stage as idle current, causing class "A" operation to prove to be a poor efficiency system.

In class "AB" or "B" operation, the Q_1 plays the role of amplification of the plus part of the signal and Q_2 that of the minus part, no matter whether idle current is large or small.
In other words, there definitely exists a period in which, when one transistor is on, the other transistor keeps cutting off, in these operations.

Switching distortion or crossover distortion is caused at the moment of this active status turning into cut-off status or the cut-off status into the active status. Nevertheless, as these operation forms have high efficiency with small idle current, it is much easier to use class "AB" or "B" operation for high power amplification rather than class "A".

A power amplifier enjoying the merit of each of these systems —— that is, practically no crossover or switching distortion being caused in class "A" operation and easier high power amplification being achieved by class "B" —— has been realized by adopting the variable bias circuit.

The idea of a variable bias circuit is that in no case the output stage is allowed to be cut-off by increasing and decreasing bias voltage in corresponding with the voltage of input signal.

Fig. 4 shows the variable vias circuit adopted in ALPHA 220.

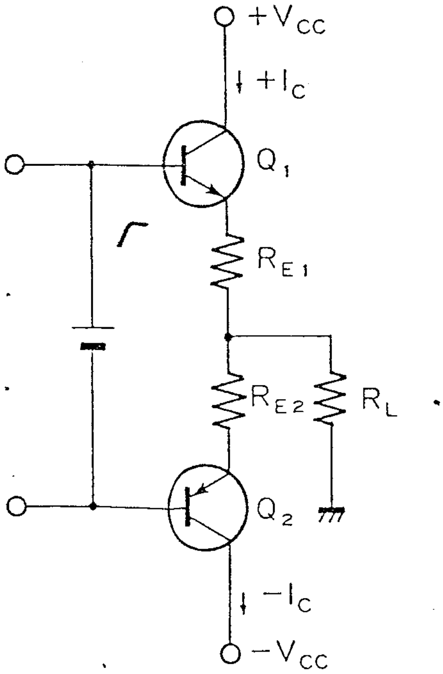


Figure 2 SEEP CIRCUIT

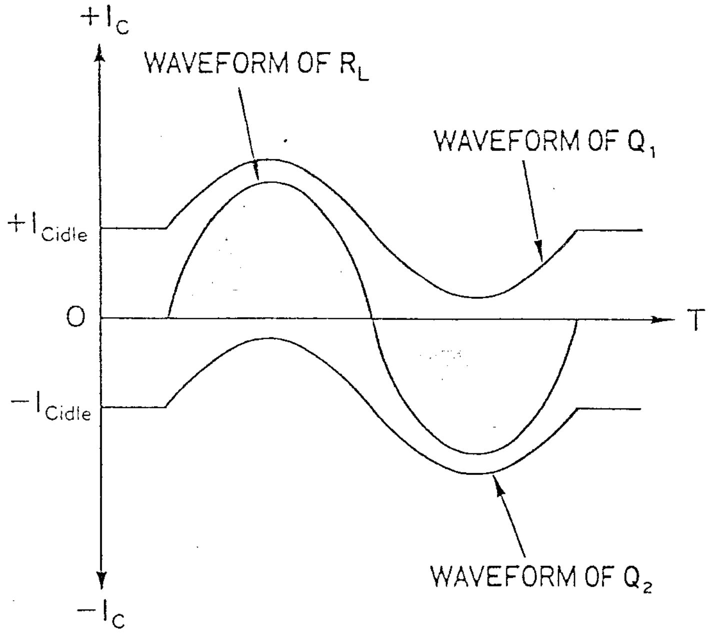


Figure 3-1 CLASS-A OPERATION

3. Hi-fT POWER TRANSISTORS

For detailes characteristics, refer to "SEMICONDUCTOR DATA" at the end of this manual.

The power transistors employed in ALPHA 220 realize an fT (Current Gain-bandwidth Product) of 80 MHz with NPN type and 60 MHz with PNP type (each being a typical value) in spite of its high Pc (Collector Power Dissipation) such as 150 W (The value when Tc = 25° C). Compared with conventional transistors with a Pc of 150 W where fT was around 10 MHz at maximum, the high speed attained by these Hi-fT power transistors is remarkable.
Such high fT has been realized specially by the inside construction of these transistors which is greatly different from that of conventional ones —— the multi-emitter construction.

In this construction, the emitter inside the transistor is divided into many units and emitter resistors with small resistance are inserted to each unit, resulting in a parallel connection.

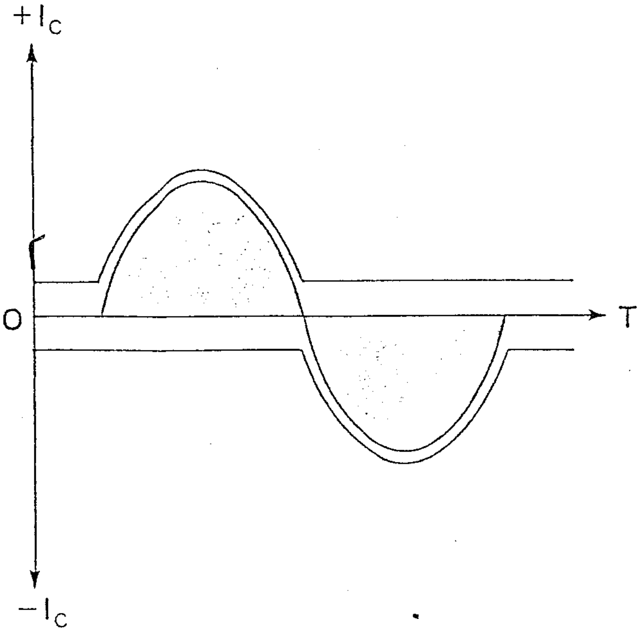


Figure 3-4 OPERATION OF BARIAVLE BIAS

This equivalently means that many small signal transistors with high fT and switching speed are parallelly connected, which has made it possible to realize such a high power characteristic while maintaining high switching speed.

Thanks to such construction as mentioned above, these power transistors are excellent in linearity of its *hfe*.
Furthermore, as dissipation is dispersed equally to each emitter due to the emitter-divided construction, they have another feature of being strong against breakdown as compared with conventional power transistors.

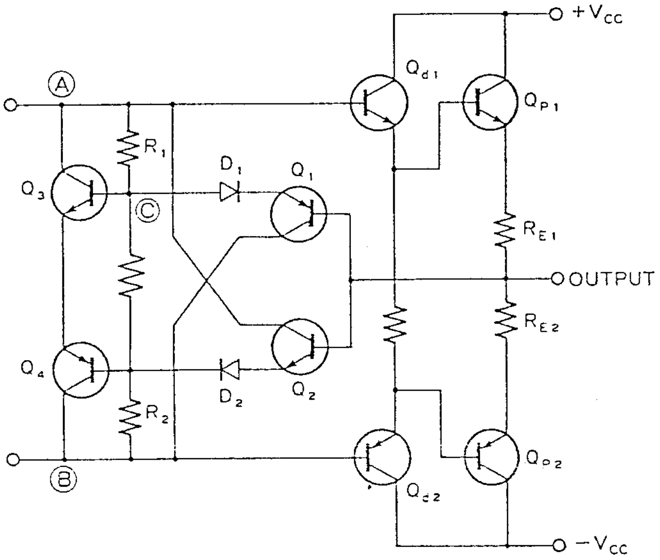


Figure 4 VARIABLE-BIAS CIRCUIT

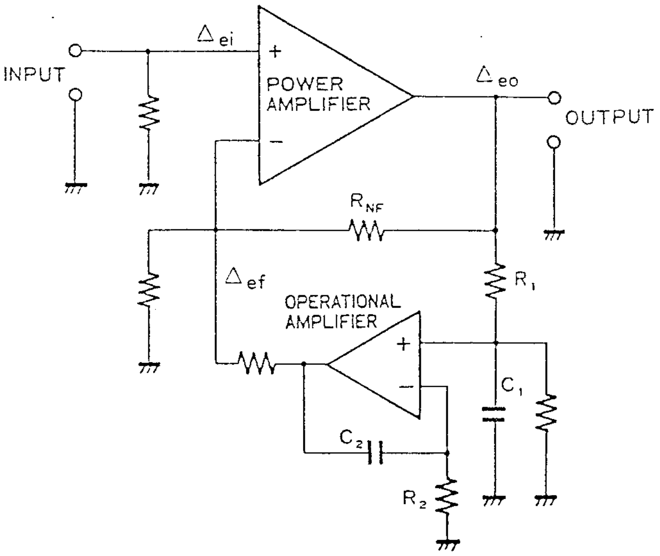


Figure 5 DC-SERVO CIRCUIT

PARTS LOCATION

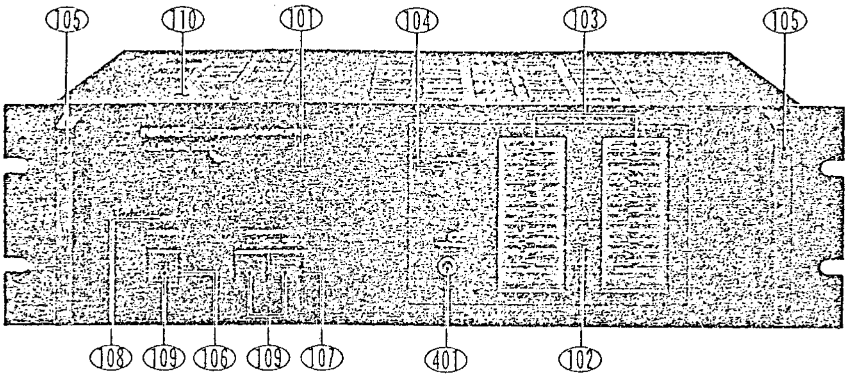


Photo 4

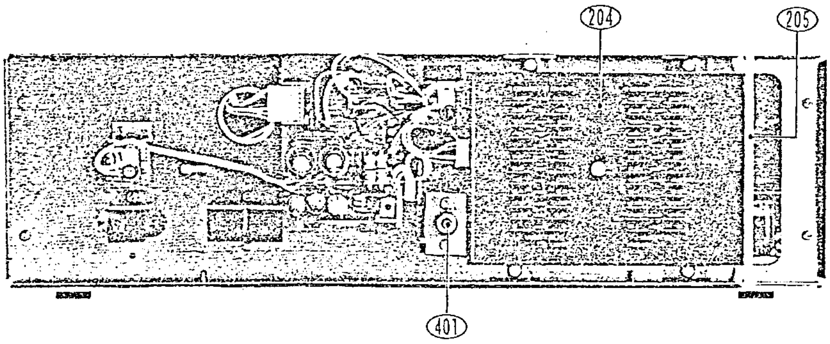


Photo 5

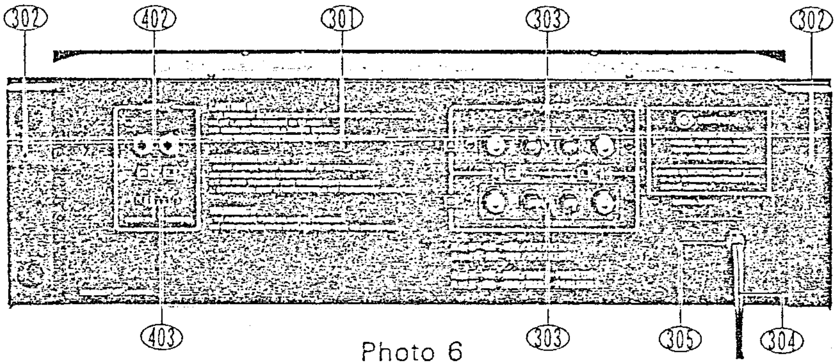


Photo 6

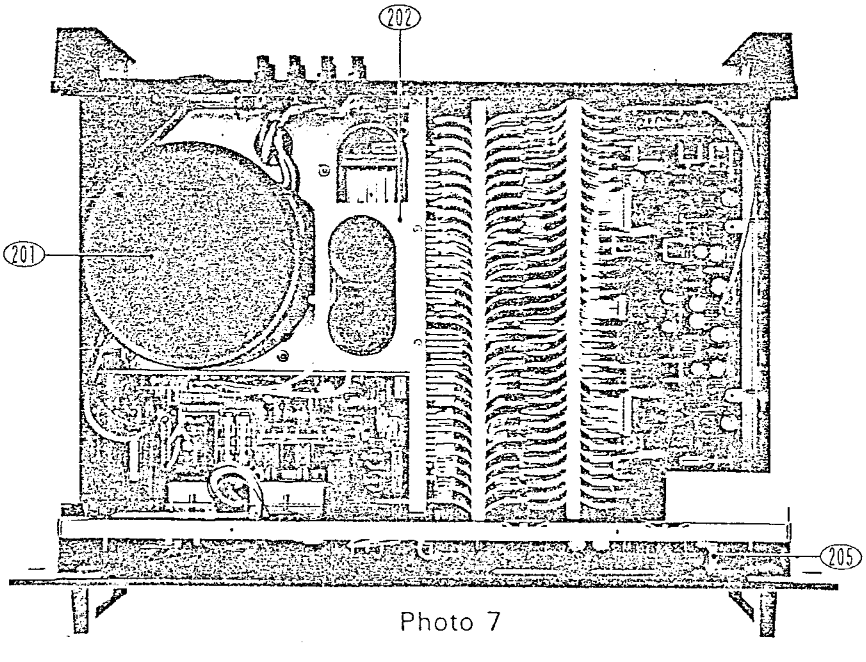


Photo 7

ALIGNMENT

ALIGNMENT PRECAUTIONS

1. As the ALPHA 220 is a power amplifier with large output power, it consumes much electrical power and a great amount of current flows in the power source line of the primary side. Therefore, in the case when it is connected to the source by an extension cord, the size of the extension cord should be equal or larger than that of the power source cord of the ALPHA 220. Otherwise, the voltage might be reduced or the extension cord might generate excessive heat because of the resistance which the cord has, then not only can proper alignment be done, but also it is very dangerous.

2. If the power sources are supplied to the ALPHA 220 and the instruments by branching off from one cord, the voltage is sometimes dropped down and the stability of the instruments goes down.
The ALPHA 220 and the instruments should be connected to the power sources by using independent cords. The ALPHA 220 must take the power source from AC outlet of the wall side.

3. As there are many parts which hold high voltages in the circuit and the parts inside of the ALPHA 220, be careful not to receive an electric shock. In the case of connecting and taking off the instruments, you must turn off the power switch of the ALPHA 220 before getting on the work.

4. When the circuit happens to be shorted by the drivers or test probes used for alignment through mistake, the circuit and the parts will be damaged. As the damage is larger than that of ordinary amplifiers and receivers, close attention is needed. It is advised that the turning driver, excluding the top part, should be wrapped with insulation tape or a driver made of plastic or some kind of insulating material should be used.

5. As the dummy load resistor generates heat while alignment, it gets very hot and you may be burnt if you touch it with bare hands. It is better if you can put the dummy load resistor in a place away from being touched, but the wire between the dummy load resistor and the amplifier should not be long. Contrive some method, like putting the dummy load resistor in a well ventilated box. Further, as more than 5 A current might flow in the wire connecting the dummy load resistor and the amplifier, at least larger than AWG #18 thick wire should be used.

6. All the adjustments in the following should be done after the slide switch on the rear panel is set in the "NORMAL" position.

TEST EQUIPMENT

Allow a minimum of 10 minutes warm-up for test equipment.

Maintain rated line voltage.

Audio Frequency Generator
Distortion Meter
Oscilloscope
AC Voltmeter
DC Voltmeter
2-Dummy Load Resistors, 8 ohms, 250 W

All the semi fixed resistors of the MAIN AMP PCB are set around the center position temporarily. (HVR701 and HVR702.)

IDLING CURRENT ADJUSTMENT

1. Connect the 8 ohms dummy load resistors to the left and right channel speaker terminals.
2. Connect the DC voltmeter across the wireing terminal No. 12 and "TP-L" (left channel) or No. 16 and "TP-R" (right channel). (see Photo 8)
3. Turning on the power switch of the ALPHA 220. Adjust the semi fixed resistor HVR701 (left channel) or HVR702 (right channel) so that the DC voltmeter indicates 18 mV ± 1 mV.
4. Turn off the power switch of the ALPHA 220 and remove the DC voltmeter.

METER CIRCUIT ADJUSTMENT

NOTE: See illustration, Figure 8, for test equipment hook-up.

1. Connect 8 ohms dummy load resistors to the left and right channel speaker terminals.
2. Connect the AC voltmeter, distortion meter and the oscilloscope to the left (right) channel speaker terminals. Connect the generator to left (right) channel input terminal.
3. Turning on the power switch of the ALPHA 220.
4. Set the frequency of the generator to 1 KHz. Adjust the output level of the generator so as to make the output power 98 W. (28 V AC voltmeter reading.)
5. Adjust the semi-fixed resistors of the POWER LEVEL INDICATOR PCB, so that the LED of "120 W" dimly lights up.
6. Turning off the power switch of the ALPHA 220.
7. Remove all test equipment.

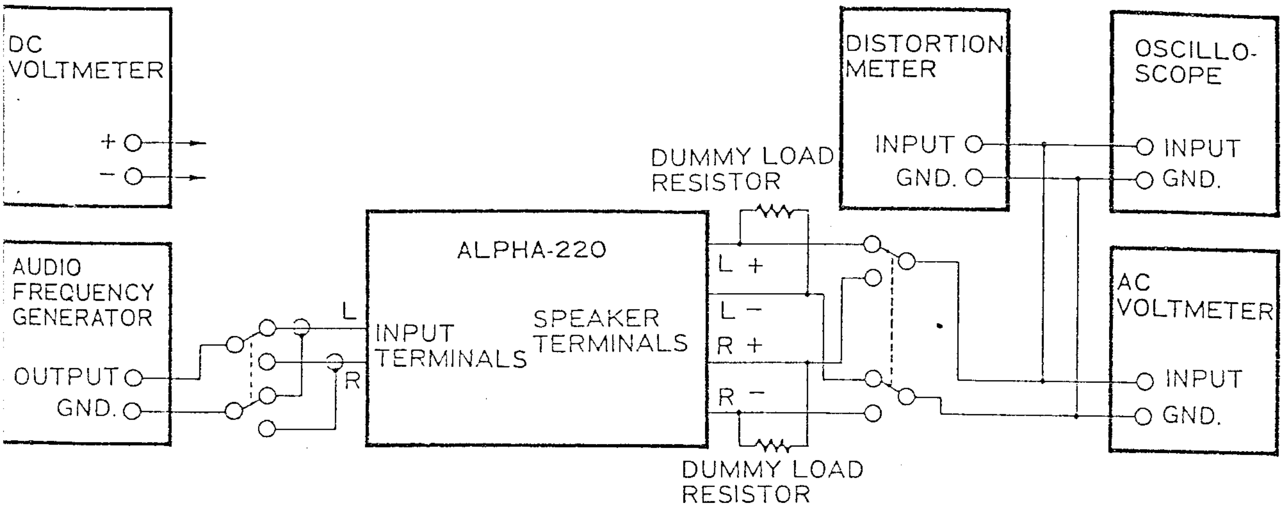


Figure 8 TEST EQUIPMENT HOOK-UP

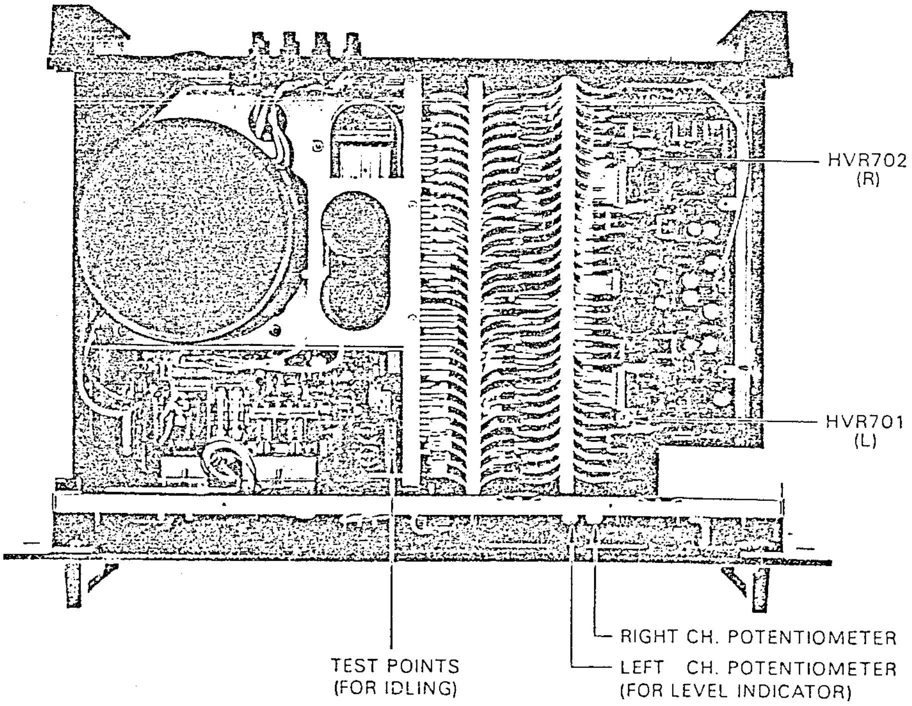


Photo 8 ADJUSTMENT POINTS

PARTS LIST

1. ★ The KEY NUMBER (#) marked with a (★) on parts list relate to number of three digits with a (◯). (Photo 4 ~ 7)
2. \+ Numberals in file indicate the quantity of parts used in one type.
3. ++

TR :	Transistor
FET :	Field effect transistor
VR :	Volume control (Variable resistor)
RES :	Carbon film fixed resistor
MO-RES :	Metal oxide film fixed resistor
CEM-RES :	Cemented wirewound fixed resistor
FP :	Flame proof
C-CAP :	Ceramic capacitor
E-CAP :	Aluminum electrolytic capacitor
M-CAP :	Polyester film capacitor
S-CAP :	Polystyrene film capacitor
T-CAP :	Tantalum electrolytic capacitor
BP-CAP :	Bipolar electrolytic capacitor
LC-CAP :	Low current leakage electrolytic capacitor.

4. Assemblies and parts are subject to change without notice.
5. Parts ordering procedure:
   - A. DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control # for the factory only)
   - B. Include in any order
     - a. Part number.
     - b. Part description.
     - c. Model number.

   (any of the above lacking from an order may delay shipment of that order.)

CAUTION:

The ⚠ mark, the KEY NO. and the SYMBOL NO. circled with rectangle in the schematic diagram and the shaded area in the parts list designate components which have special characteristics important for safety and should be replaced only with types identical to those in the original circuit or specified in the parts list.

KEY NO.	SYMBOL NO.	TYPE+ W E B	DESCRIPTION++	PART NO.
			PACKING MATERIALS & ACCESSORIES	
001		1 1 1	Carton box	9825790
002		2 2 2	Pad	9840970
003		1 1 1	Sack, polyethylen cloth	9640740
004		1 1 1	Sack, polyethylen cloth – #13	9640320
005a		1 – –	Manual, instructions – English and French	960340E
005b		– 1 1	Manual, instructions – in five different languages	960340K
006		1 – –	Manual, safety instructions	9670410
007a		1 – –	Card, warranty – U.S.A.	967043A
007b		1 – –	Card, warranty – Canada	9670420
008		1 – –	List, service stations	9690210
009		1 1 1	Cord, RCA phono pin plug – 2T-1	962014A
			CABINET ASSEMBLY	
★101a		1 1 1	Panel, front – SILVER	7885060
★101b		1 1 1	Panel, front – BLACK	7885050
★102a		1 1 1	Panel, power level indicator – SILVER	7870540
★102b		1 1 1	Panel, power level indicator – BLACK	7870490
★103		1 1 1	Window, power level indicator	7802650
★104		1 1 1	Globe, LED – protection indicator	7402540
★105a		2 2 2	Handle – 100G – SILVER	7490180
★105b		2 2 2	Handle – 100B – BLACK	7490190
★106		1 1 1	Guide, button – 1P18 – power switch	7402550
★107		1 1 1	Guide, button – 2P18 – speakers selector	7402560
★108		1 1 1	Globe, LED – input power indicator	7402120
★109a		3 3 3	Button, push – M18GL – power/speakers, SILVER	7852290
★109b		3 3 3	Button, push – M18BK – power/speakers, BLACK	7852300
★110		1 1 1	Cover, top	7821110
111		1 1 1	Plate, bottom	7326430
112		4 4 4	Foot, polyethylen – 22ϕx10	7401350
			CHASSIS ASSEMBLY	
⚠ ★201a		1 – –	Transformer, power – T-1-397 – AC 120V	1103970
⚠ ★201b		– 1 1	Transformer, power – T-1-413 – AC220 or 240V	1104130
★202		1 1 1	Supporter, filter capacitors	7002510
203		1 1 1	Power level indicator assembly	4582770
★204		1 1 1	Inside panel, power level indicator	7802660
★205		1 1 1	Light guide, level indicator	7401580
206		1 1 1	Lamp – 8V 0.3A	5808210
			BACK PLATE ASSEMBLY	
★301a		1 – –	Plate, back – (W)	7326390
★301b		– 1 1	Plate, back – (E)	7326400
★302		2 2 2	Block, terminal guard	7401860
★303		2 2 2	Terminal, speakers – screw type 4P	4450480
⚠ ★304a		1 – –	Cord, AC line – SPT-1	606010A
⚠ ★304b		– 1 –	Cord, AC line – CEE-2T	600508A
⚠ ★304c		– – 1	Cord, AC line – BS	600515A
⚠ ★305a		1 – –	Bush, power cord – SR-3P-4	7400620
⚠ ★305b		– 1 1	Bush, power cord – SR-4N-4	7400690
			MAIN AMP PC BOARD ASSEMBLY	
			(POWER OUTPUT SECTION)	
	Q727,728	2 2 2	TR 2SD882 (P or Q)	5 13119S
	Q729,730	2 2 2	TR 2SB772 (P or Q)	5 11120S
	Q731,732, Q735,736	4 4 4	TR 2SC2565 (O or R)	5 12127S
	Q733,734, Q737,738	4 4 4	TR 2SA1095 (O or R)	5 10123S
	C741,742	2 2 2	M-CAP 0.047uf 10% 400V	2 73473K
	C743 ~ C746	4 4 4	E-CAP 1uf 100V	2 11810Q
	R781 ~ R788	8 8 8	CEM-RES 0.1ohm 2Wx2	382109P
	R789,790	2 2 2	FP-MO-RES 10ohm 2W	362100L
			(DRIVER PCB SECTION)	
	IC701	1 1 1	IC AN6552	5 18096S
	Q701,702	2 2 2	FET 2SK 150A (GR)	5 16038S
	Q703 ~ Q706	4 4 4	TR 2SC1845 (E or F)	5 12115S
	Q707 ~ Q710	4 4 4	TR 2SA1144 (O or Y)	5 10120S
	Q711,712	2 2 2	TR 2SC1941 (L or K)	5 12112S
	Q713,714	2 2 2	TR 2SC2704 (O or Y)	5 12122S
	Q715,716	2 2 2	TR 2SA992 (E or F)	5 10110S
	Q717,718	2 2 2	TR 2SC1845 (E or F)	5 12115S
	Q719,720	2 2 2	TR 2SC1815 (Y or GR)	5 12107S
	Q721,722	2 2 2	TR 2SA1015 (Y or GR)	5 10102S
	Q723,724	2 2 2	TR 2SC2275 (P or Q)	5 12120S
	Q725,726	2 2 2	TR 2SA985 (P or Q)	5 10118S
	D701 ~ D704	4 4 4	Diode 2-0A90	5 00013G
	D705 ~ D708	4 4 4	Diode 1S2076	5 01019S
	D709,710	2 2 2	Diode GP10-4002	5 30066S
	D802	1 1 1	Diode W02	5 50061S
	ZD701 ~ ZD704	4 4 4	Zener diode RD22EB4	5 02059S
	ZD705,706	2 2 2	Zener diode RD13EB3	5 02063S
	TH701 ~ TH704	4 4 4	Thermistor D2FHL-103S	5 400180

PART ORDERING PROCEDURE ----- DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control # for the factory only.) Include in any order: a. Part number, b. Part description, c. Model number. (any of the above lacking from an order may delay shipment of the order.)

KEY NO.	SYMBOL NO.	TYPE$^+$ W E B	DESCRIPTION^{++}	PART NO.
	C703,704	2 2 2	C-CAP 100pf 10% 50V	232101K
	C705 ~ C708	4 4 4	E-CAP 100uf 25V	211330Q
	C709,710	2 2 2	C-CAP 150pf 10% 50V	232151K
	C711,712	2 2 2	M-CAP 0.047uf 10% 200V	272473K
	C713,714	2 2 2	C-CAP 6pf 10% 500V	234609K
	C715,716	2 2 2	C-CAP 3pf 10% 500V	234309K
	C717,718	2 2 2	C-CAP 47pf 10% 500V	234470K
	C719,720	2 2 2	C-CAP 100pf 10% 500V	234101K
	C721,722	2 2 2	BP-CAP 22uf 16V	215222N
	C723,724	2 2 2	BP-CAP100uf 16V	215230N
	C725,726	2 2 2	BP-CAP 22uf 16V	215222N
	C727,728	2 2 2	E-CAP 100uf 16V	211230Q
	C803,804	2 2 2	E-CAP 1000uf 80V	2100130
	HVR701 ~ 702	2 2 2	Potentiometer 5kohm	4301410
	R701,702	2 2 2	RES 2.7kohm 5% ¼W	328272J
	R703,704	2 2 2	RES 47kohm 5% ¼W	328473J
	R705,706	2 2 2	RES 6.8kohm 5% ¼W	328682J
	R707 ~ R710	4 4 4	RES 2.7kohm 5% ¼W	328272J
	R711,712	2 2 2	RES 100ohm 5% ¼W	328101J
	R713 ~ R716	4 4 4	FP-MO-RES 5.6kohm 5% 1W	361562L
	R717,718	2 2 2	RES 560ohm 5% ¼W	328561J
	R719,720	2 2 2	RES 15kohm 5% ¼W	328153J
	R721 ~ R724	4 4 4	RES 4.7kohm 5% ¼W	328472J
	R725,726	2 2 2	RES 2.7kohm 5% ¼W	328272J
	R727 ~ R730	4 4 4	RES 820ohm 5% ¼W	328821J
	R731,732	2 2 2	RES 82ohm 5% ¼W	328820J
	R733,734	2 2 2	RES 100ohm 5% ¼W	328101J
	R735,736	2 2 2	FP-MO-RES 3.9kohm 5% 1W	361392L
	R737 ~ R740	4 4 4	RES 180ohm 5% ¼W	328181J
	R741,742	2 2 2	RES 1kohm 5% ¼W	328102J
	R743,744	2 2 2	RES 1.8kohm 5% ¼W	328182J
	R745,746	2 2 2	RES 1kohm 5% ¼W	328102J
	R747 ~ R750	4 4 4	FP-RES 220ohm 5% ¼W	328221L
	R751 ~ R754	4 4 4	FP-RES 820ohm 5% ¼W	328821L
	R755 ~ R758	4 4 4	FP-RES 390ohm 5% ¼W	328391L
	R759,760	2 2 2	FP-MO-RES 270ohm 5% 1W	361271L
	R761,762	2 2 2	RES 100kohm 5% ¼W	328104J
	R763 ~ R766	4 4 4	RES 10kohm 5% ¼W	328103J
	R767,768	2 2 2	FP-MO-RES 5.6kohm 5% 1W	361562L

REGULATOR PC BOARD ASSEMBLY

(REGULATOR SECTION)

KEY NO.	SYMBOL NO.	TYPE$^+$ W E B	DESCRIPTION^{++}	PART NO.
⚠	F801	1 – –	Fuse – 8A 250V MGC	4700760
⚠	F802,803	2 – –	Fuse – 0.8A 250V MGC	4700580
⚠	F801	– 1 1	Midget fuse – T4.0A 250V	4720400
⚠	F802,803	– 1 1	Midget fuse – T0.8A 250V	4720320
⚠	SW1	1 – –	Switch, push – SDZ-1P TV-8 – power	4041500
⚠	SW1	– 1 1	Switch, push – ESB-90179S – power	4041600
	D801	1 1 1	Diode S10VB20	560058S
	C801,802	2 2 2	E-CAP 15000uf 71V	2100120
⚠	C806	1 – –	M-CAP 0.01uf 125V	284103M
⚠	C806	– 1 1	M-CAP 0.01uf 250V	283103M
	Q801,802	2 2 2	TR 2SC2229 (Y)	512108S
	Q803	1 1 1	TR 2SA992 (E or F)	510110S
	Q804	1 1 1	TR 2SC1815 (Y or GR)	512107S
	Q805	1 1 1	TR 2SA1015 (Y or GR)	510102S
	Q806	1 1 1	TR 2SC2235 (O, Y)	512109S
	Q807	1 1 1	TR 2SC2240 (Y or GR)	512102S
	D803 ~ D807	5 5 5	Diode 1S2076A	501020S
	D808	1 1 1	Diode GP10-4002	560066S
	ZD801	1 1 1	Zener diode RD22EB4	502059S
	L701,702	2 2 2	Coil, choke – 1uH	1210960
	C807,808	2 2 2	BP-CAP 1uf 50V	215510N
	C809	1 1 1	E-CAP 1uf 50V	211510Q
	C810	1 1 1	BP-CAP 100uf 10V	215130N
	C811	1 1 1	E-CAP 47uf 25V	211325Q
	C812	1 1 1	E-CAP 10uf 16V	211220Q
	C818	1 1 1	E-CAP 1uf 50V	211510Q
	R791,792	2 2 2	FP-MO-RES 10ohm 5% 2W	362100L
	R801,802	2 2 2	RES 2.2kohm 5% ¼W	328222J
	R803,804	2 2 2	RES 22kohm 5% ¼W	328223J
	R805,806	2 2 2	RES 82kohm 5% ¼W	328823J
	R807	1 1 1	RES 56kohm 5% ¼W	328563J
	R808	1 1 1	RES 18kohm 5% ¼W	328183J
	R809	1 1 1	RES 100kohm 5% ¼W	328104J
	R810,811	2 2 2	RES 68kohm 5% ¼W	328683J
	R812	1 1 1	RES 4.7kohm 5% ¼W	328472J
	R813	1 1 1	RES 150kohm 5% ¼W	328154J
	R814	1 1 1	RES 47ohm 5% ¼W	328470J
	R815	1 1 1	RES 220kohm 5% ¼W	328224J
	R816	1 1 1	RES 4.7kohm 5% ¼W	328472J
	R817	1 1 1	FP-MO-RES 1kohm 5% 1W	361102L

(PROTECTOR SECTION)

KEY NO.	SYMBOL NO.	TYPE$^+$ W E B	DESCRIPTION^{++}	PART NO.
	SW2,3	1 1 1	Switch, twin push – SUF-24 – speakers	4041590
	RELAY1	1 1 1	Relay – G2Z-222P – DC24V	1700300

(HEADPHONES PCB SECTION)

KEY NO.	SYMBOL NO.	TYPE$^+$ W E B	DESCRIPTION^{++}	PART NO.
★401		1 1 1	Jack, headphones	4550260
	Q808	1 1 1	TR 2SC2275 (P or Q)	512120S
	Q809	1 1 1	TR 2SC1815 (Y or GR)	512107S
	D809,810	2 2 2	Diode GP10-4002	560066S
	ZD802	1 1 1	Zener diode RD13EB3	502063S
	C813	1 1 1	E-CAP 47uf 16V	211225Q
	C814,815	2 2 2	E-CAP 330uf 25V	211333Q
	C816	1 1 1	E-CAP 100uf 25V	211330Q
	C817	1 1 1	E-CAP 33uf 25V	211323Q
	R793,794	2 2 2	FP-MO-RES 330ohm 5% 2W	362331L
	R818	1 1 1	FP-RES 270ohm 5% ½W	329271L
	R819	1 1 1	RES 1.5kohm 5% ¼W	328152J
	R821	1 1 1	RES 220kohm 5% ¼W	328224J
	R822	1 1 1	FP-RES 270ohm 5% ½W	329271L

(INPUT PCB SECTION)

KEY NO.	SYMBOL NO.	TYPE$^+$ W E B	DESCRIPTION^{++}	PART NO.
★402		1 1 1	Terminal, RCA phono pin jack – 2P	4442070
★403		1 1 1	Switch, slide – SSB-022 – normal-direct selector	4020710
	C701,702	2 2 2	BP-CAP 2.2uf 50V	215512N

(POWER INDICATOR SECTION)

KEY NO.	SYMBOL NO.	TYPE$^+$ W E B	DESCRIPTION^{++}	PART NO.
	LED801	1 1 1	LED BR5504S	5060300
		1 1 1	Spacer, LED	7903140

(PROTECTION INDICATOR SECTION)

KEY NO.	SYMBOL NO.	TYPE$^+$ W E B	DESCRIPTION^{++}	PART NO.
	LED802	1 1 1	LED PR5527S	5060270
		1 1 1	Spacer, LED	7903110

SEMICONDUCTOR DATA

TRANSISTORS

† NOTES

Ge : Germanium
Si : Sillicon

A : Alloy
B : Base
D : Diffused
Dd : Double-diffused

Df : Drift-field
E : Epitaxial
G : Grown
J : Junction

M : Mesa
P : Planer
Pc : Point-contact
Td : Triple-diffused

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T_A = 25°C unless otherwise specified) Collector-to-Base Voltage V_{CBO} (V)	Emitter-to-Base Voltage V_{EBO} (V)	Collector Current I_C (mA)	Collector Dissipation P_C (mW)	Junction Temperature T_J (°C)	ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified) Collector Cutoff Current I_{CBO} (uA)	V_{CB} (V)	Static Forward-Current Transfer Ratio h_{FE}	V_{CE} (V)	I_C (mA)	Collector-Emitter Saturation Voltage $V_{CE(sat)}$ (V)	I_C (mA)	I_B (mA)	Gain-Bandwidth Product f_T f_{ab}* (MHz)	V_{CE} V_{CB}* (V)	I_E I_C* (mA)	Output Capacitance C_{ob} (pF)	Others	MANUFACTURER
2SA985 (P, Q)	AF, Power amp.	PNP Si-E	−120	−5	−1.5A	25W (Tc=25°C)	150	−1 max.	−120	100 ~ 320	−5	−300	−2 max.	−1A	−100	180	−5	−200*	29	Complementary to 2SC2275	NEC
2SA992 (E, F)	AF, Low noise	PNP Si-E	−120	−5	−50	500	125	−0.05 max.	−120	300 ~ 800	−6	−0.1	−0.3 max.	−10	−1	100	−6	1	3 max.	Complementary to 2SC1845	NEC
2SA1015 (Y, GR)	AF, General	PNP Si-E	−50	−5	−150	400	125	−0.1 max.	−50	120 ~ 400	−6	−2	−0.3 max.	−100	−10	80 min.	−10	−1*	7 max.	Complementary to 2SC1815	TOSHIBA
2SA1095 (O, R)	AF, Power amp.	PNP Si-E	−160	−5	−15A	150W (Tc=25°C)	150	−50 max.	−160	55 ~ 160	−5	−1A	−2 max.	−5A	−500	60	−10	−1A*	350	Complementary to 2SC2565	TOSHIBA
2SA1144 (O, Y)	AF, Driver	PNP Si-E	−150	−5	−50	10W (Tc=25°C)	150	−0.1 max.	−150	80 ~ 240	−5	−10	1 max.	−10	−1	120	−5	−10*	2.5	Complementary to 2SC2704	TOSHIBA
2SB772 (P, Q)	AF, Power amp.	PNP Si-E	−40	−5	−3A	1W	150	−1 max.	−30	100 ~ 320	−2	−20	−0.5 max.	−2A	−200	80	−5	100	55	Complementary to 2SD882	NEC
2SC1815 (Y, GR)	AF, General	NPN Si-E	60	5	150	400	125	0.1 max.	60	120 ~ 400	6	2	0.25 max.	100	10	80 min.	10	1*	3 max.	Complementary to 2SA1015	TOSHIBA
2SC1845 (E, F)	AF, Low noise	NPN Si-E	120	5	50	500	125	0.05 max.	120	300 ~ 800	6	0.1	0.3 max.	10	1	110	6	−1	2.5 max.	Complementary to 2SA992	NEC
2SC1941 (L, K)	AF, Driver	NPN Si-E	160	5	50	800	150	0.1 max.	160	135 ~ 400	10	1	0.6 max.	20	2	120	10	−10	3 max.		NEC
2SC2229 (O, Y)	AF, Driver	NPN Si-Td	200	5	50	800	150	0.1 max.	200	70 ~ 240	5	10	0.5 max.	10	1	120	30	10*	5 max.		TOSHIBA
2SC2235 (O, Y)	AF, Driver	NPN Si-E	120	5	800	900	150	1 max.	120	80 ~ 240	5	100	1 max.	500	50	120	5	100*	30 max.		TOSHIBA
2SC2240 (GR, BL)	AF, Low Noise	NPN Si-E	120	5	100	300	125	0.1 max.	120	200 ~ 700	6	2	0.3 max.	10	1	100	6	1*	3		TOSHIBA
2SC2275 (P, Q)	AF, Power amp.	NPN Si-E	120	5	1.5A	25W (Tc=25°C)	150	1 max.	120	100 ~ 320	5	300	2 max.	1A	100	200	5	200*	19	Complementary to 2SA985	NEC
2SC2565 (O, R)	AF, Power amp.	NPN Si-E	160	5	15A	150W (Tc=25°C)	150	50 max.	160	55 ~ 160	5	1A	2 max.	5A	500	80	10	1A*	200	Complementary to 2SA1095	TOSHIBA
2SC2704 (O, Y)	AF, Driver	NPN Si-E	150	5	50	10W (Tc=25°C)	150	0.1 max.	150	80 ~ 240	5	10	1 max.	10	1	200	5	10*	1.8	Complementary to 2SA1144	TOSHIBA
2SD882 (P, Q)	AF, Power amp.	NPN Si-E	40	5	3A	1W	150	1 max.	30	100 ~ 320	2	20	0.5 max.	2A	200	90	5	−100	45	Complementary to 2SB772	NEC

FIELD EFFECT TRANSISTOR

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values (T_A = 25°C unless otherwise specified) Gate-to-Drain Voltage V_{GDO} (V)	Gate-to-Source Voltage V_{GSO} (V)	Gate Current I_G (mA)	Drain Current I_D (mA)	Total Dissipation P_D (mW)	Channel Temperature T_{ch} (°C)	ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified) Gate Leak Current Test Conditions	I_{GSS} (nA)	Gate to Drain Breakdown Voltage Test Conditions	$V_{(BR)GDO}$ (V)	Drain Current Test Conditions	I_{DSS} (mA)	Gate to Source Cutoff Voltage Test Conditions	$V_{GS(off)}$ (V)	Forward Transfer Admittance Test Conditions	$\lvert Y_{fs} \rvert$ (m℧)	Feed Back Capacitance Test Conditions	C_{rss} (pF)	Power Gain (Common Source) Test Conditions	G_{ps} (dB)	Noise Figure Test Conditions	NF (dB)	MANUFACTURER
2SK150 A (GR)	AF, Low noise Differential amp.	Si N-channel junction (Dual)	−50	−50	10		200 unit	125	V_{GS} = −30V V_{DS} = 0	−1 max.			V_{DS} = 10V V_{GS} = 0	2.6 ~ 6.5			V_{DS} = 10V V_{GS} = 0 f = 1 kHz I_{DSS} = 3mA	12	V_{DG} = 10V I_D = 0 f = 1 MHz	3			V_{DS} = 10V R_g = 1 kΩ I_D = 1 mA f = 1 kHz	2 max.	TOSHIBA

DIODES, LED'S

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T_A = 25°C unless otherwise specified) Reverse Surge Voltage V_{Rsurge} (V)	Peak Reverse Voltage V_{RM} (V)	Reverse Voltage V_R (V)	Peak Forward Voltage V_{FM} (V)	Peak Forward Current I_{FM} (mA)	Average Rectified Current I_O (mA)	Forward Surge Current $I_{F\,surge}$ (A)	Junction Temperature T_J (°C)	Total Power Dissipation P_D (mW)	ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified) Forward Current I_{Fmin} (mA)	Test Condition V_F (V)	Forward Voltage V_{Fmax} (V)	Test Condition I_F (mA)	Reverse Current I_{Rmax} (uA)	Test Condition V_R (V)	Others	MANUFACTURER
2-0A90	Detector	Ge-Pc			15		150		0.4	75		4	1						MATSUSHITA
1S2076	Medium speed Switching	Si-EP		35	30		450	150	1	175	250			0.8	10	1	30		HITACHI
1S2076A	Medium speed Switching	Si-EP		70	60		450	150	1	175	250			0.8	10	1	30		HITACHI
GP10 -4002	Rectifier	Si-DJ		100	70			1A	30	175				1.1	1A	5			GENERAL INSTRUMENT
W02	Rectifier	Si-DJ (Bridge)			200	200		1.5A	50	125				1.0	1A	10		R_{th} = 50°C/W	GENERAL INSTRUMENT
S10VB20	Rectifier	Si-DJ (Bridge)		200				10A	200	150				1.05		10			SHINDENGEN
BR5504S	Lamp (red)	GaAlAs			4		300	I_F = 50		85	100			2.0	20	100	4	I_V = 80 mcd (I_F = 20 mA)	STANLEY
PR5527S	Lamp (red)	GaP			4		100	I_F = 30		85	75			2.0	10	100	4	I_V = 1.2 mcd (I_F = 10 mA)	STANLEY

ZENER DIODES

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T_A = 25°C unless otherwise specified) Total Power Dissipation P_D (mW)	Zener Current I_Z (A)	Junction Temperature T_J (°C)	ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified) Zener Voltage V_Z MIN (V)	TYP (V)	MAX (V)	Test Conditions I_Z (mA)	Differential Resistance r_Z TYP (Ω)	MAX (Ω)	Test Conditions I_Z (mA)	Temperature Coefficient γ_Z TYP (%/°C)	MAX (%/°C)	Test Conditions I_Z (mA)	Reverse Current I_Z MAX (μA)	Test Conditions V_R (V)	Others	MANUFACTURER
RD13EB3	Regulator	Si-J	400		175	12.99		13.66	10		25	10				2	10		NEC
RD22EB4	Regulator	Si-J	400		175	21.52		22.63	5		60	5				2	17		NEC

ITEGRATED CIRCUITS AN6552

Manufacturer:	MATSUSHITA
Applications:	Dual Operational Amplifier

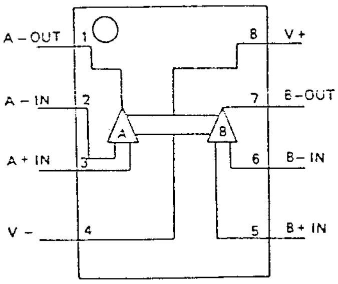
BSOLUTE MAXIMUM RATINGS

Supply Voltage	±18 V	Input Voltage	±15 V
Internal Power Dissipation	500 mW	Storage Temperature Range	−40°C to +125°C
Differential Input Voltage	±30 V	Operating Temperature Range	−20°C to +75°C

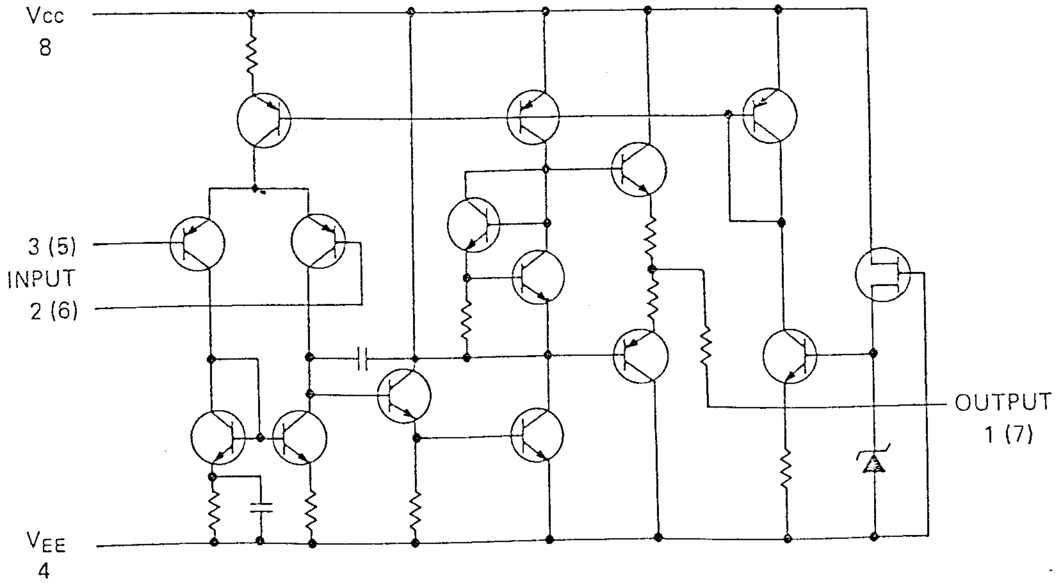
LECTRICAL CHARACTERISTICS (V$_{CC}$ = ±15V, T$_A$ = +25°C unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage	$R_S \leqslant 10\ k\Omega$		0.5	6.0	mV
Input Offset Current			5	200	nA
Input Bias Current				500	nA
Large-Signal Voltage Gain	$R_L \geqslant 2\ k\Omega$ $V_{out} = \pm 10V$	86	100		dB
Output Voltage Swing	$R_L \geqslant 2\ k\Omega$	±10	±13		V
Common Mode Rejection Ratio	$R_S \leqslant 10\ k\Omega$	70	90		dB
Supply Voltage Rejection Ratio	$R_S \leqslant 10\ k\Omega$		30	150	μV/V
Slew Rate	$R_L \geqslant 2\ k\Omega$		1		V/μS

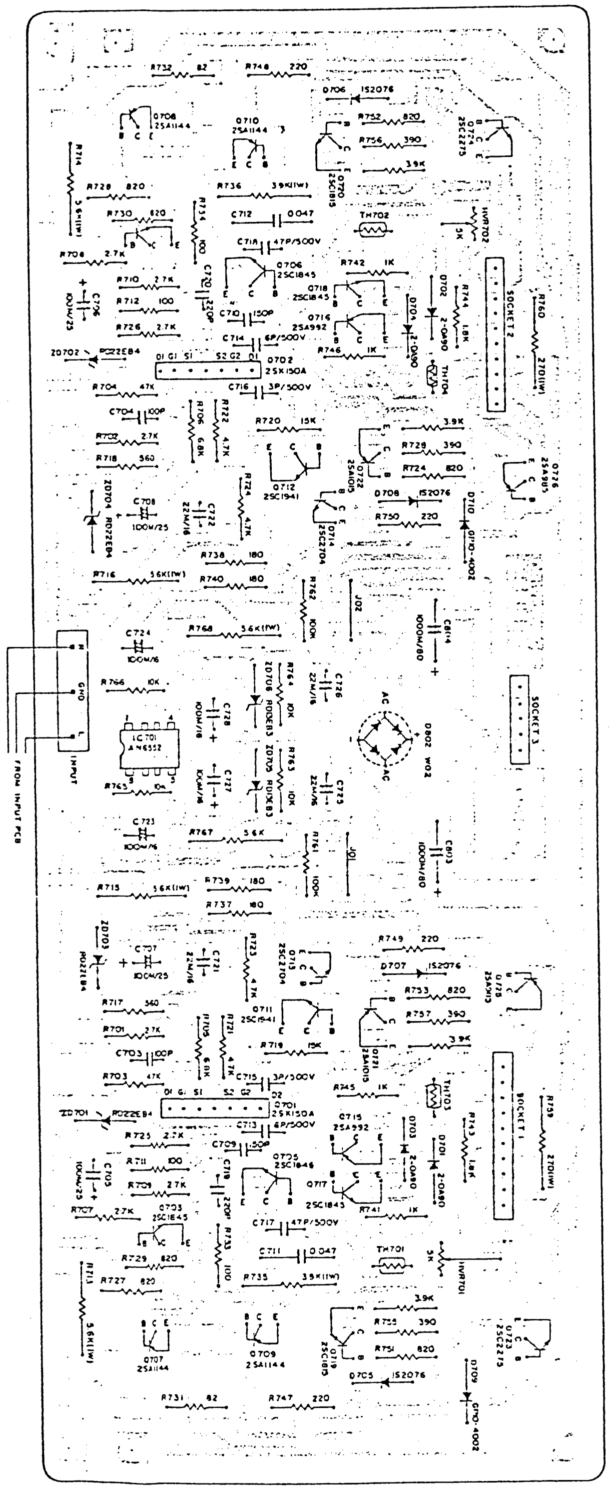
ERMINAL GUIDE (TOP VIEW)



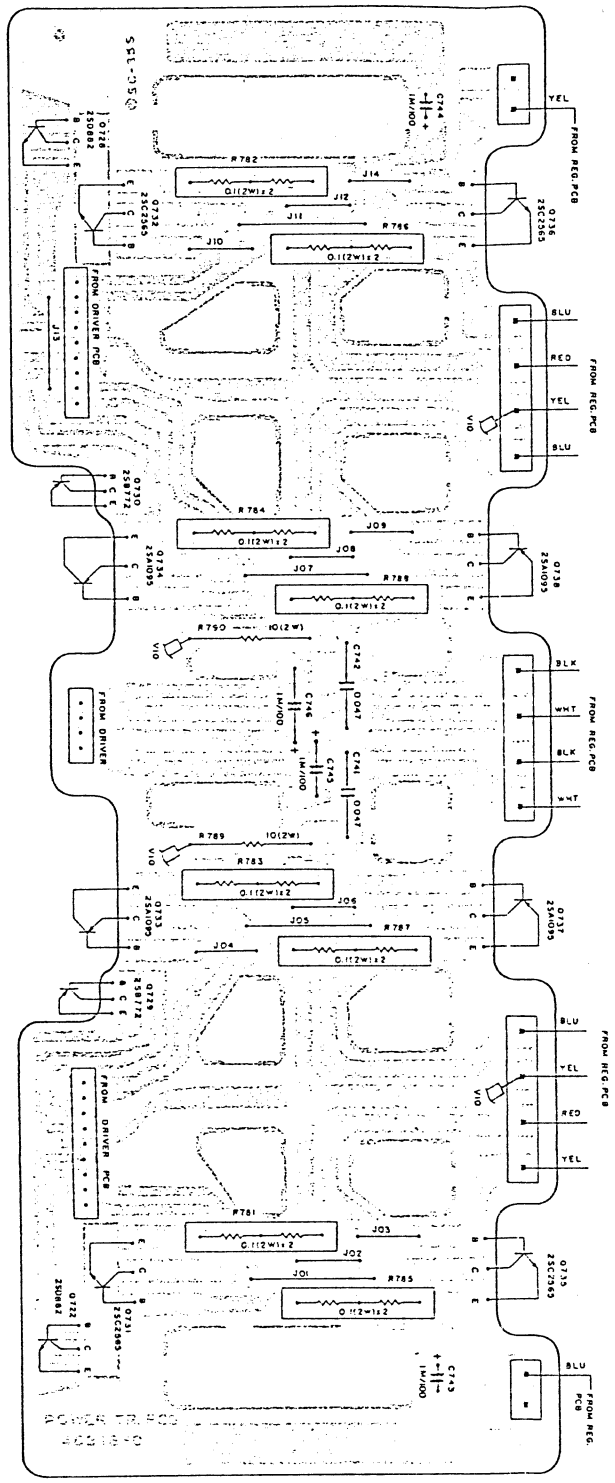
CHEMATIC DIAGRAM (1/2 CIRCUIT)



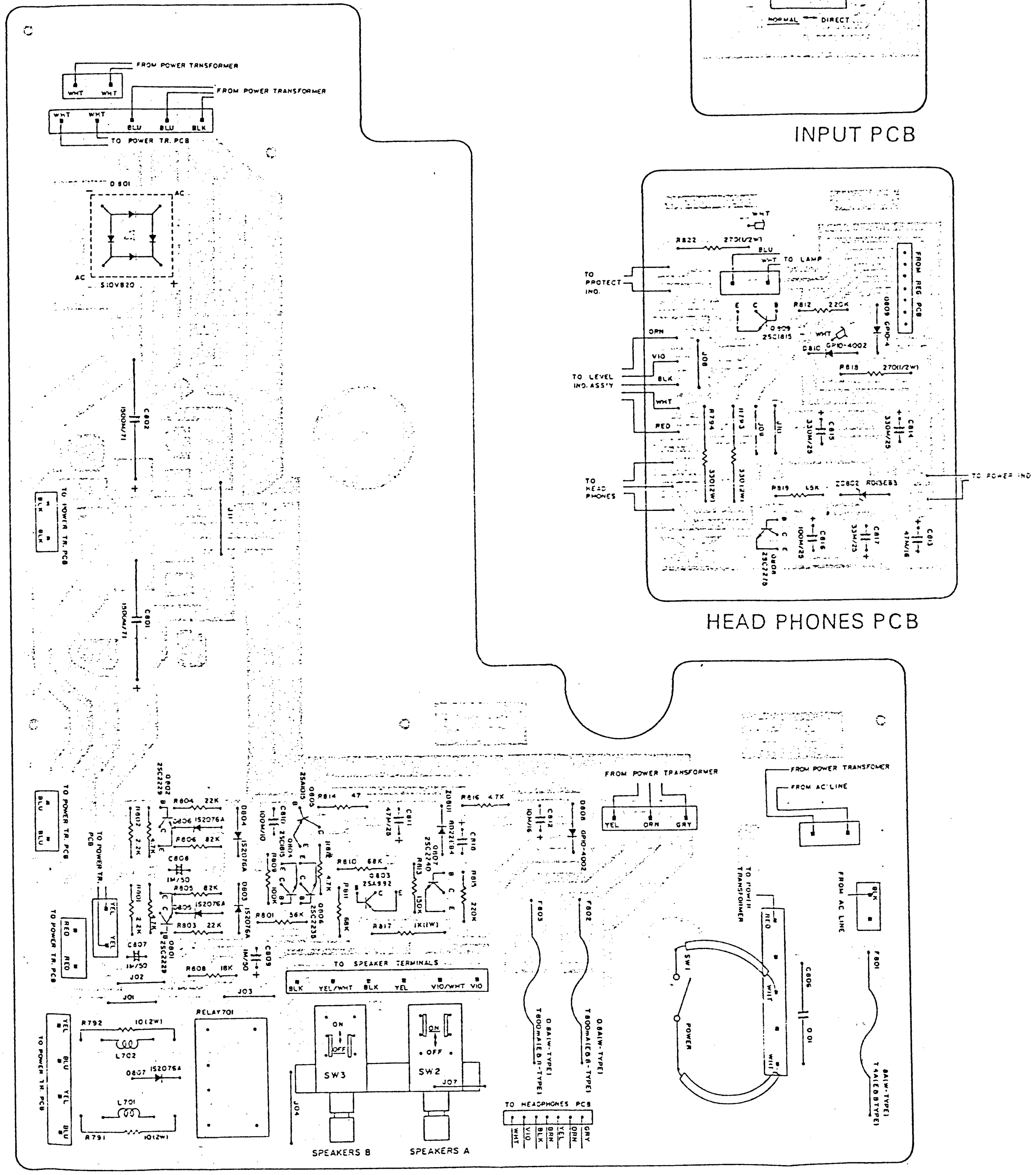
P.C. BOARD (BOTTOM VIEW) Figure 7



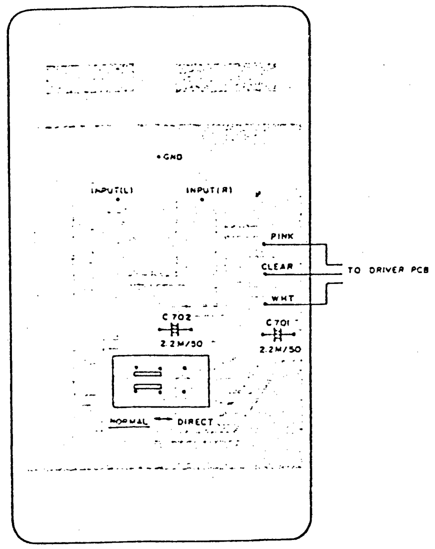
DRIVER PCB



1 POWER TRANSISTORS PCB



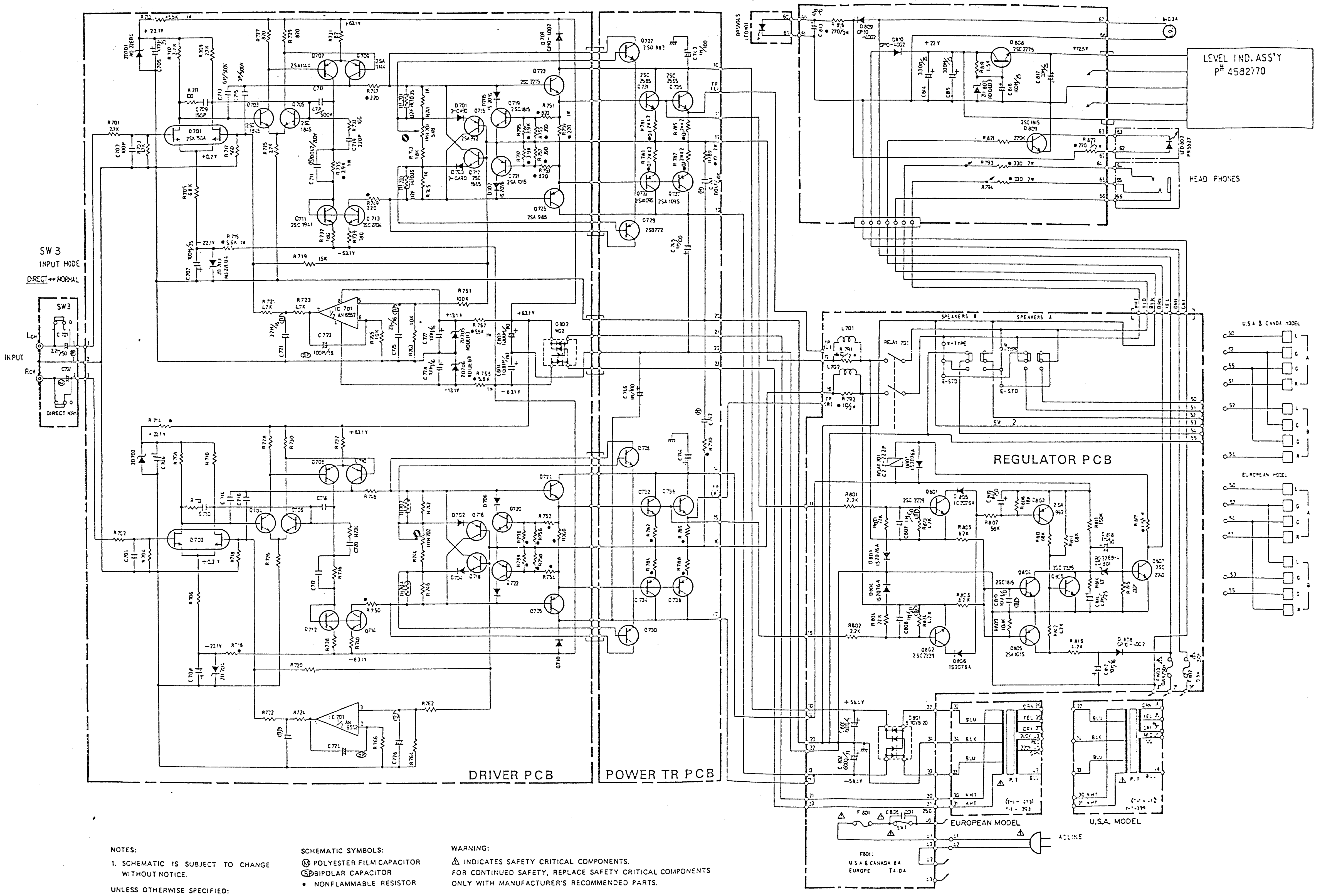
REGULATOR PCB



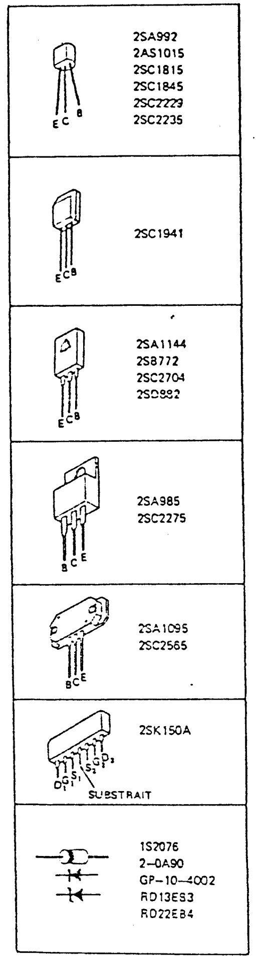
INPUT PCB

HEAD PHONES PCB

SCHEMATIC DIAGRAM



SEMICONDUCTORS



NOTES:

1. SCHEMATIC IS SUBJECT TO CHANGE WITHOUT NOTICE.

UNLESS OTHERWISE SPECIFIED:

2. RESISTANCE VARUES ARE IN OHMS. K = 1,000 ; M = 1,000,000
3. CAPACITANCE VALUES 1.0 AND ABOVE ARE IN pF OR μF (P = pF, M = μF). LESS THAN 1.0 ARE IN μF. (ELECTROLYTIC CAPACITANCE VALUES ARE IN μF/WV.)
4. VOLTAGES ARE MEASURED TO CHASSIS GROUND WITH A "DC VOLTMETER".

SCHEMATIC SYMBOLS:

Ⓜ POLYESTER FILM CAPACITOR
(BP) BIPOLAR CAPACITOR
● NONFLAMMABLE RESISTOR

WARNING:

⚠ INDICATES SAFETY CRITICAL COMPONENTS.
FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.

Figure 6