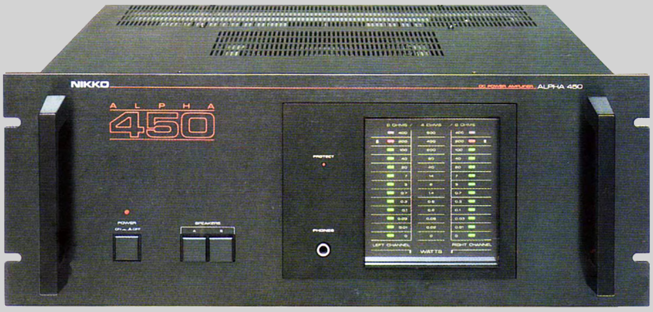
NIKKO POWER AMP

ALPHA 450

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

CONTENTS

SPECIFICATIONS

AMPLIFIER SECTION

Continuous Power Output per Channel:

20~20k Hz (8Ω)	>220 Watts
20~20k Hz (4Ω)	>240 Watts
1kHz (8Ω)	>240 Watts
1kHz (4Ω)	>240 Watts

T. H. Distortion, 8Ω:

at Continuous Power Output	≯0.008%
at 1 Watt Power Output	≯0.02%

T. H. Distortion, 4Ω:

at Continuous Power Output	≯0.02%

I. M. Distortion, 8Ω:

at Continuous Power Output	≯0.01%
at 1 Watt Power Output	≯0.02%
IHF Power Bandwidth, 8Ω:	10Hz~700kz
Damping Factor at 1kHz, 8Ω:	>80

Frequency Response

"NORMAL" input, 8Ω: at 1 Watt Power Output	20Hz~100kHz +0, -1dB

Input Sensitivity for 300 Watts Power Output:

MAIN IN	1V ±2dB

Signal to Noise Ratio, IHF A" Network:

MAIN (NORMAL, DIRECT)	>115dB

Signal to Noise Ratio, DIN Filter:

MAIN IN (NORMAL, DIRECT)	>90dB
Channel Balance:	≯1dB
Residual Hum & Noise, 8Ω:	≯0.4 mV
Idling Current:	50~150mA
Midpoint Voltage:	0 ±30mV
Muting Delay Time:	2 ~ 7 seconds

GENERAL

Power Requirement:

W-TYPE	AC 120V, 60Hz
E-TYPE	AC 220V, 50Hz
B-TYPE	AC 240V, 50Hz
Power Consumption:	800W (1.25kVA)
Ambient Temperature during Operation:	-10~30°C

Dimensions:

Width	482 mm (19 inches)
Height	182 mm (7¼ inches)
Depth	460 mm (18⅛ inches)
Weight, without package:	21.5kg (47.3 Ibs)

*Specifications are subject to change without notice.

DISASSEMBLY

Cabinet Cover Removal

a. Remove 6 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 11 tapping screws (#1- #11) from the bottom of the unit as shown in Photo 1.
b. Lift the bottom plate away from the unit.

Front Panel Removal

a. Remove 4 tapping screws (#1- #4) from the left side of the unit as shown in Photo 2.
b. Similarly remove 4 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 & the bottom plate.
b. Disconnect all the cables from the power transformer.
c. Remove 4 nuts (#1- #4) from the chassis as shown in Photo 3.
d. Lift the power transformer away from the unit.

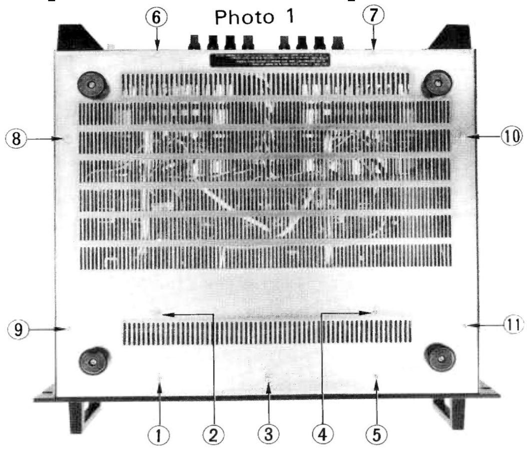


Photo 1

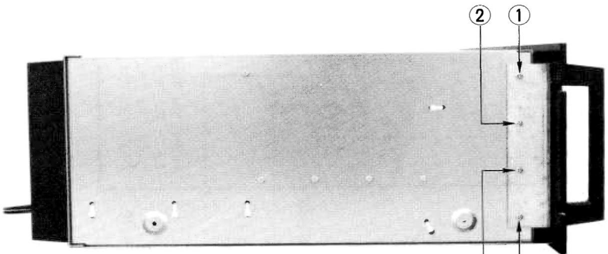


Photo 2

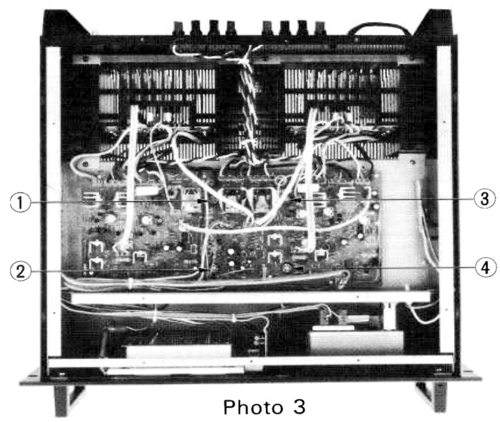


Photo 3

CIRCUIT DESCRIPTION

NIKKO's ALPHA 450, adopting latest devices such as Hi-f_T power transistors, is of a design introducing a variable bias circuit (non-switching circuit), a DC servo circuit & other most advanced techniques.

The following are explanations of the main circuits & devices.

Variable Bias Circuit

Currently, in the output stage of power amplifiers are mostly used SEPP (Single Ended Push Pull) circuits. (Fig. 2).

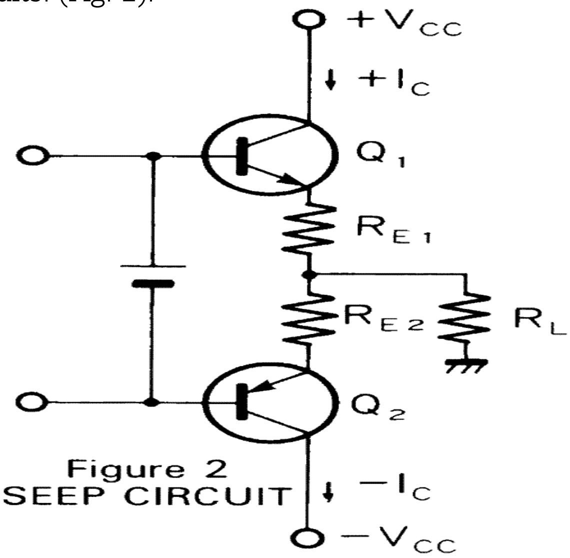


Figure 2
SEEP CIRCUIT

It is generally known that the current (idle current) flowing through NPN & PNP transistors of this circuit can be classified into three large groups of operation form, class "A", class "AB" & class "B". (Fig. 3).

In class "A" operation, neither of collector currents, Q_1 & Q_2 becomes zero nor cut off. Even when the current flowing to the load R is zero, a certain current is flowing through Q_1 & Q_2 & so no crossover distortion exists theoretically.

To realise 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 & Q_1 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".

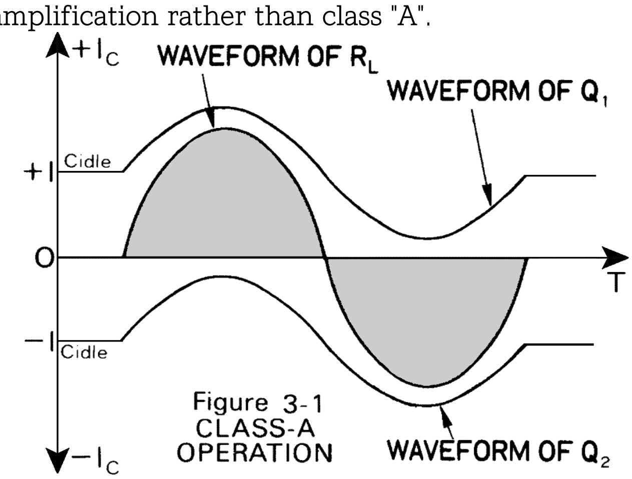


Figure 3-1
CLASS-A
OPERATION

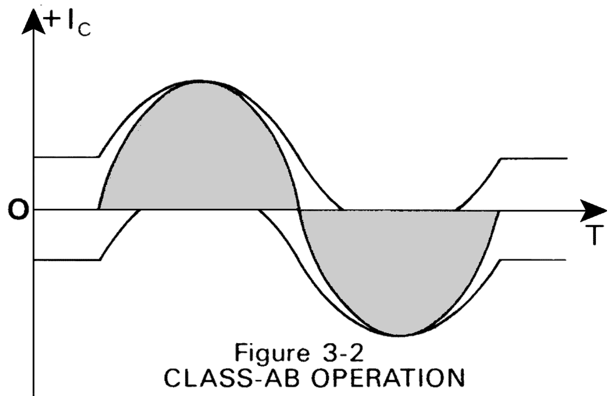


Figure 3-2
CLASS-AB OPERATION

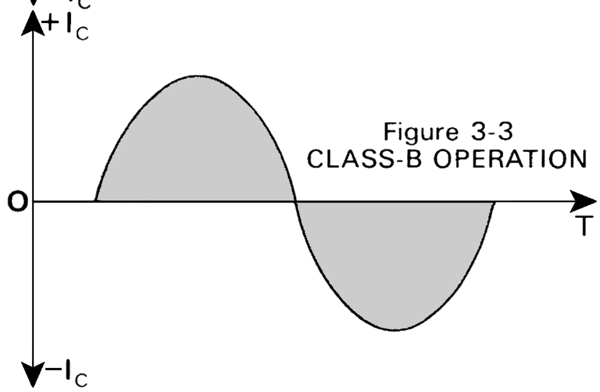


Figure 3-3
CLASS-B OPERATION

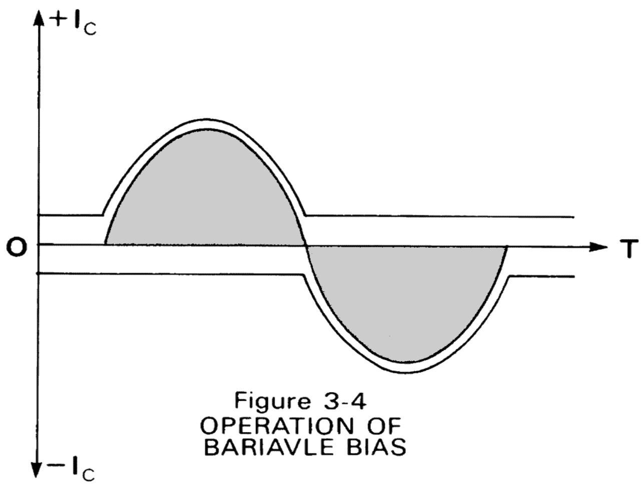


Figure 3-4
OPERATION OF
BARIAVLE BIAS

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 & easier high power amplification being achieved by class "B" — has been realised 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 & decreasing bias voltage in corresponding with the voltage of input signal.

Fig. 4 shows the variable bias circuit adopted in ALPHA 450.

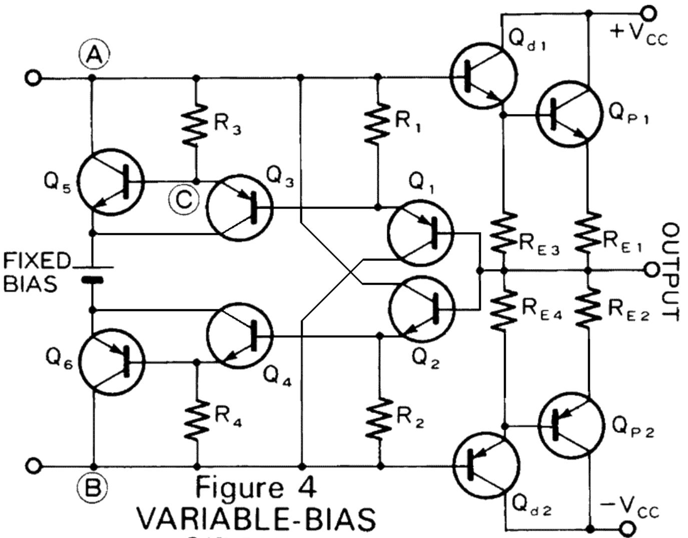


Figure 4
VARIABLE-BIAS
CIRCUIT

Now, suppose the + wave (plus part) of signal has been inputted, the currents of Q_{p1} & Q_{d1} increase & the voltage at both ends of R_{E1} & R_{E3} become high, resulting in a rise in the voltage between point (A) & OUTPUT. '

At that time, the voltage at both ends of R_1 & R_3 becomes high because current flows R_1>Q_1 & R_3-Q_3, causing the potential at (C) point to lower & the voltage of Q_5 between collector & emitter to rise. As a result, the voltage between A & (B) rises & Q_{p2}, & Q_{d2} is kept from being cut-off.

From another point of view, the voltage drops at the emitter resistors R_{E1} & R_{E3} (these resistors are indispensable to protect transistors in stabilising bias of the output stage or at the time of abnormal current flowing) are cancelled by the drops at R_1 & R_4, thus protecting Q_{p2} & Q_{d2} from becoming zero or anti-bias.

In the same manner, when the -wave (-part) of signal has been inputted, current flows Q_2-R_2 & Q_4=R_4, resulting in a rise of V_{CE} at Q_6, thus protecting Q_{p1} & Q_{d1} from being cut-off.

DC Servo Circuit
DC amplification is the most advanced form adopted for audio amplifiers as there is no phase lag over all the range from DC to audio frequency.

However, in a perfect DC amplifier (which is an amplifier having no coupling capacitors in its input part & NFB loop), a DC drift is caused in case a direct current is inputted or when the DC balance between each element has been lost due to temperature rise inside the amplifier.

The DC servo circuit is to suppress such a drift & realise a more stabilised amplifier.

The principle of a DC servo circuit is something like that of a comparator, in which changes in DC current between the output point & the ground is detected & drifts of the amplifier is controlled with their results used as the output of the servo circuit.

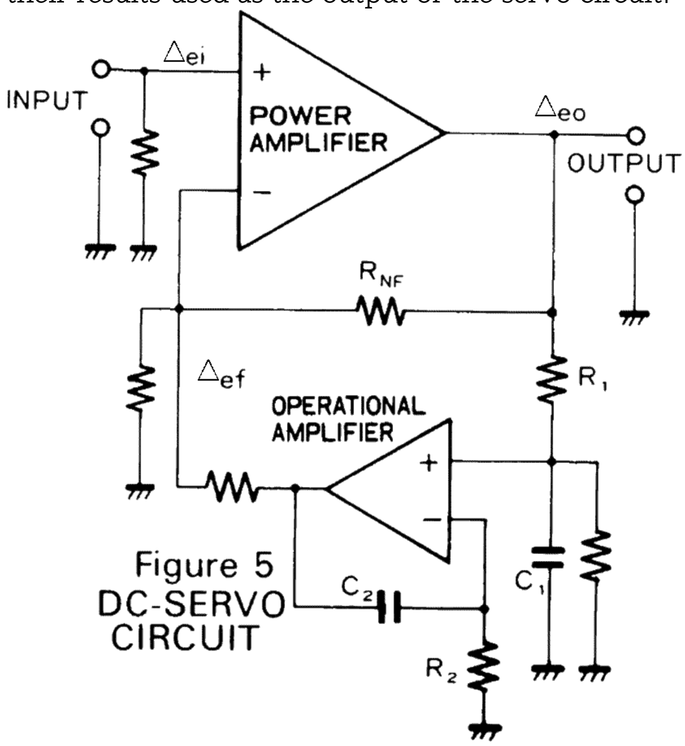


Figure 5
DC-SERVO
CIRCUIT

The basic elements are an integrating circuit composed of C_1 & R_1, an operational amplifier & a mirror integrator composed of C_2 & R_2. (Fig. 5).

Now, suppose a drift Δeo has been caused at the output of the power amplifier, a potential with the same phase Δef is outputted at the output of the operational amplifier.

On the other hand, the initial stage of the power amplifier is a differential amplifier. When Δef is inputted at its inverting input, the potential at the non-inverting input Δei changes in the opposite direction of Δef, resulting in a decrease of drift at the output of the power amplifier.

The DC servo circuit has a specific frequency characteristic. In the range of DC & ultra low frequency, gain of the power amplifier is kept at one over several tens of decibel, & in the audio frequency band, amplification at a certain gain can be made in the same manner as ordinary power amplifier.

The frequency on which the DC servo circuit starts to have effects is determined by the four elements, C_1, R_1, C_2 & R_2.

Hi-f_T Power Transistors
For details characteristics, refer to "SEMICONDUCTOR DATA" at the end of this manual.

The power transistors employed in ALPHA 450 realise an f_T (Current Gain-bandwidth Product) of 80MHz with NPN type & 60MHz with PNP type (each being a typical value) in spite of its high P_c (Collector Power Dissipation) such as 150W (The value when T_c = 25°C). Compared with conventional transistors with a Pc of 150W where f_T was around 10MHz at maximum, the high speed attained by these Hi-f_T power transistors is remarkable.

Such high f_T has been realised 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 & emitter resistors with small resistance are inserted to each unit, resulting in a parallel connection.

This equivalently means that many small signal transistors with high f_T & switching speed are connected in parallel , which has made it possible to realise 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 h_{fe}.

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.

ALIGNMENT

Alignment Precautions

1. As the ALPHA 450 is a power amplifier with large output power, it consumes much electrical power & 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 450. 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 450 & the instruments by branching off from one cord, the voltage is sometimes dropped down & the stability of the instruments goes down. The ALPHA 450 & the instruments should be connected to the power sources by using independent cords. The ALPHA 450 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 & the parts inside of the ALPHA 450, be careful not to receive an electric shock. In the case of connecting & taking off the instruments, you must turn off the power switch of the ALPHA 450 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 & the parts will be damaged. As the damage is larger than that of ordinary amplifiers & receivers, close attention is needed. It is advised that the screw 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 & you may be burnt if you touch it with bare hands. It's better if you can put the dummy load resistor in a place away from being touched, but the wire between the dummy load resistor & the amplifier should not be long. Contrive some method, like putting the dummy load resistor in a well ventilated box. Further, as >10A current might flow in the wire connecting the dummy load resistor & the amplifier, at least larger than AWG #18 thick wire should be used.
6. The slide switch near the "INPUT LEVEL" volume on the rear panel of the amplifier is to be set in the "NORMAL" position. All the adjustments in the following should be done after the slide switch 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, 8Ω, 500W
2-Dummy Load Resistors, 4Ω, 500W

All the semi fixed resistors of the MAIN AMP PCB are set around the centre position temporarily. (HVR701~706, HVR901 & HVR902)

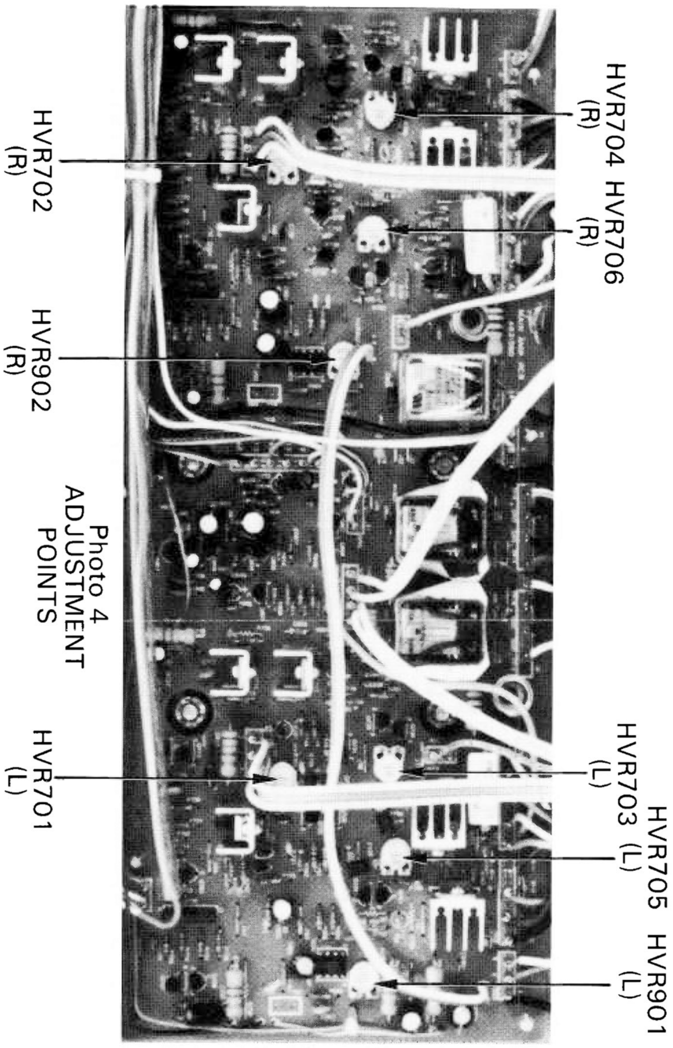


Photo 4 ADJUSTMENT POINTS

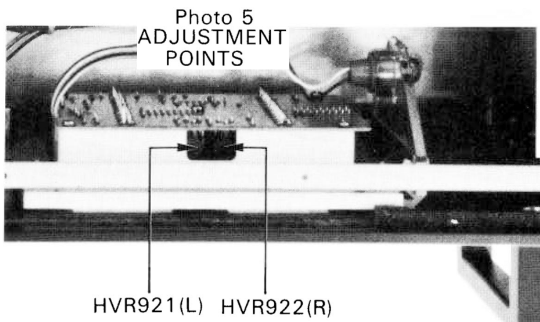


Photo 5 ADJUSTMENT POINTS

DC BALANCE ADJUSTMENT

1. Connect 8Ω dummy load resistors to the left & right channel speaker terminals.
2. Turn the “INPUT LEVEL’ volume controls down to the fully counter clockwise, & set it to “MIN".
3. Turning on the power switch of the ALPHA 450.
4. Adjust the semi-fixed resistor R901 (left-ch) or R902 (right-ch) for a 0V ±5mV on DC voltmeter.
5. Turning on the power switch, till the DC balance settled down. This takes about 10 minutes. So after adjustment, keep the power switch for 10 minutes, then make sure the DC balance again.
6. Turning off the power switch. Remove the DC voltmeter & 8Ω dummy load resistors.

LIMITER CIRCUIT ADJUSTMENT

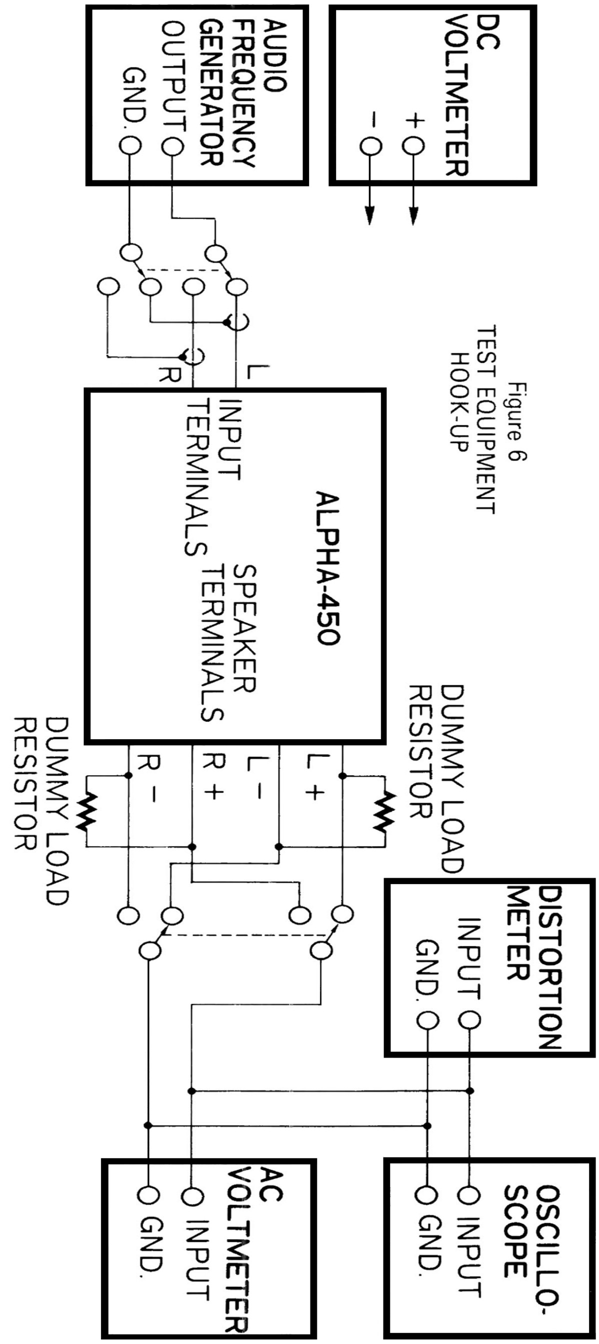


Figure 6 TEST EQUIPMENT HOOK-UP

NOTE: Fig 6, for test equipment hook-up.

1. Connect 4Ω dummy load resistors to the left & right channel speaker terminals.
2. Connect the AC voltmeter, distortion meter & 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 450.
4. Turn the "INPUT LEVEL" volume control fully clockwise, & set it to "MAX".
5. Set the frequency of the generator to 1kHz. Adjust the output level of the generator so as to make the output power 260W. (32.5VAC voltmeter reading.)
6. Adjust the semi-fixed resistors HVR703~HVR706 so that the upper & the lower side peaks of the output waveform begin to clip. (HVR703 & 705 are for the left-ch, HVR704 & 706 for the right.)
7. Turning off the power switch. Remove 4Ω dummy load resistors.

IDLING CURRENT ADJUSTMENT

1. Connect the 8Ω dummy load resistors to the left & right-ch speaker terminals. Connect the DC voltmeter across the wiring terminals No. 16 & 17 (left-ch) or No. 35 & 36 (right-ch on the MAIN AMP PCB.
2. Turning on the power switch of the ALPHA 450. Adjust the semi fixed resistor HVR701 (left-ch) or HVR702 (right-ch) so that the DC voltmeter indicates 18mV ±1mV.
3. Turn off the power switch of the ALPHA 450 & remove the DC voltmeter & 8Ω dummy load resistors.

POWER LEVEL INDICATOR ADJUSTMENT

NOTE: Fig 6, for test equipment hook-up.

1. Connect 8Ω dummy load resistors to the left & right-ch speaker terminals.
2. Connect the AC voltmeter, distortion meter & 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 450.
4. Turn the "INPUT LEVEL" volume control fully clockwise, & set it to "MAX"".
5. Set the frequency of the generator to 1kHz. Adjust the output level of the generator so as to make the output power 170W. (37VAC voltmeter reading.)
6. Adjust the semi-fixed resistors HVR921 (left-ch) & HVR922 (right-ch) of the LEVEL INDICATOR PCB so that the LED of "200W" dimly lights up.
7. Turning off the power switch of the ALPHA 450.
8. Remove all test equipment.

Power Transistors Mounting Assembly

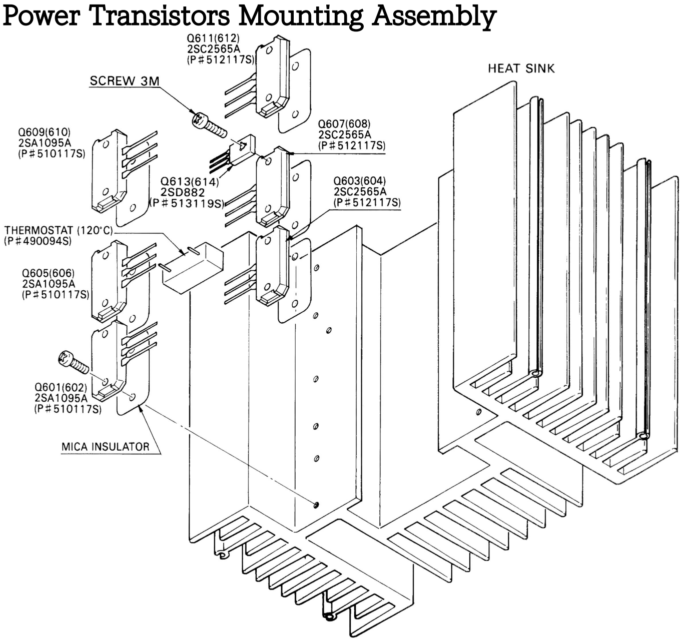


Figure 9 NOTE: For best heat conduction, use thermally conductive silicon grease between the power transistor and the mica insulator and between the insulator and the heat sink.

Parts Locations

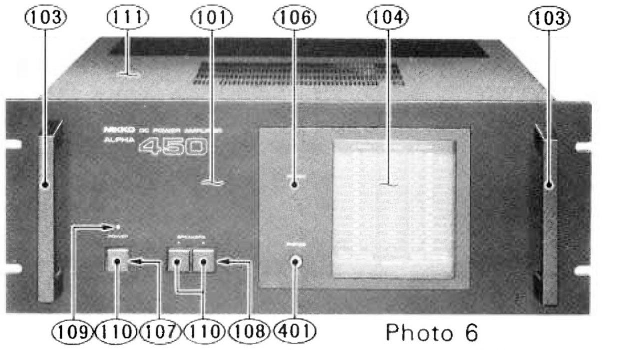


Photo 6

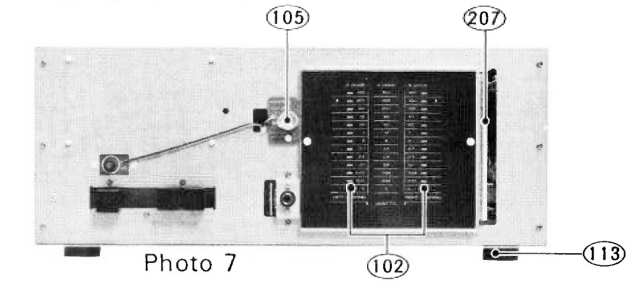


Photo 7

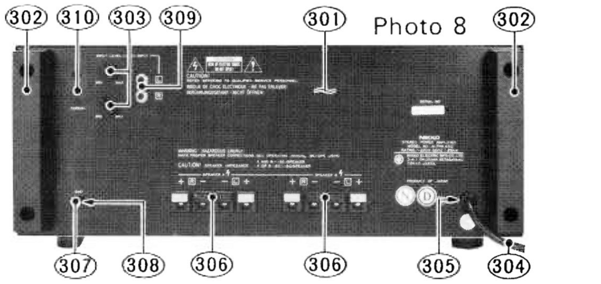


Photo 8

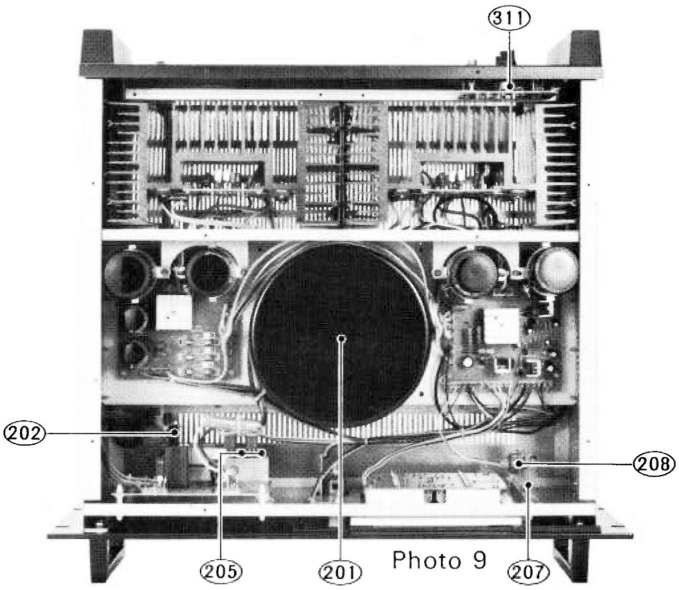


Photo 9

Precautions For Repair Service

Many of these items are included just as a reminder — they are normal procedures for experienced technicians. Short-cuts can be taken: but, often they cause additional damage to transistors, circuit components or the printed circuit board.

1. Do not bridge electrolytic capacitors with AC power. The resultant surges may damage solid state devices.
2. Do not bias the base of any transistor while voltage is being applied to its collector.
3. Replacements for output and driver transistors, if necessary, must be made from the same hfe group as the original type. Be sure to include this information when ordering replacement transistors.
4. If one output transistor burns out (open or shorts), always remove all output transistors in that channel and check the bias adjustment, the control and other parts in the network with an ohmmeter before inserting a new transistor. All output transistors in one channel will be destroyed if the base biasing circuit is open in the emitter end.

SAFETY INSTRUCTIONS

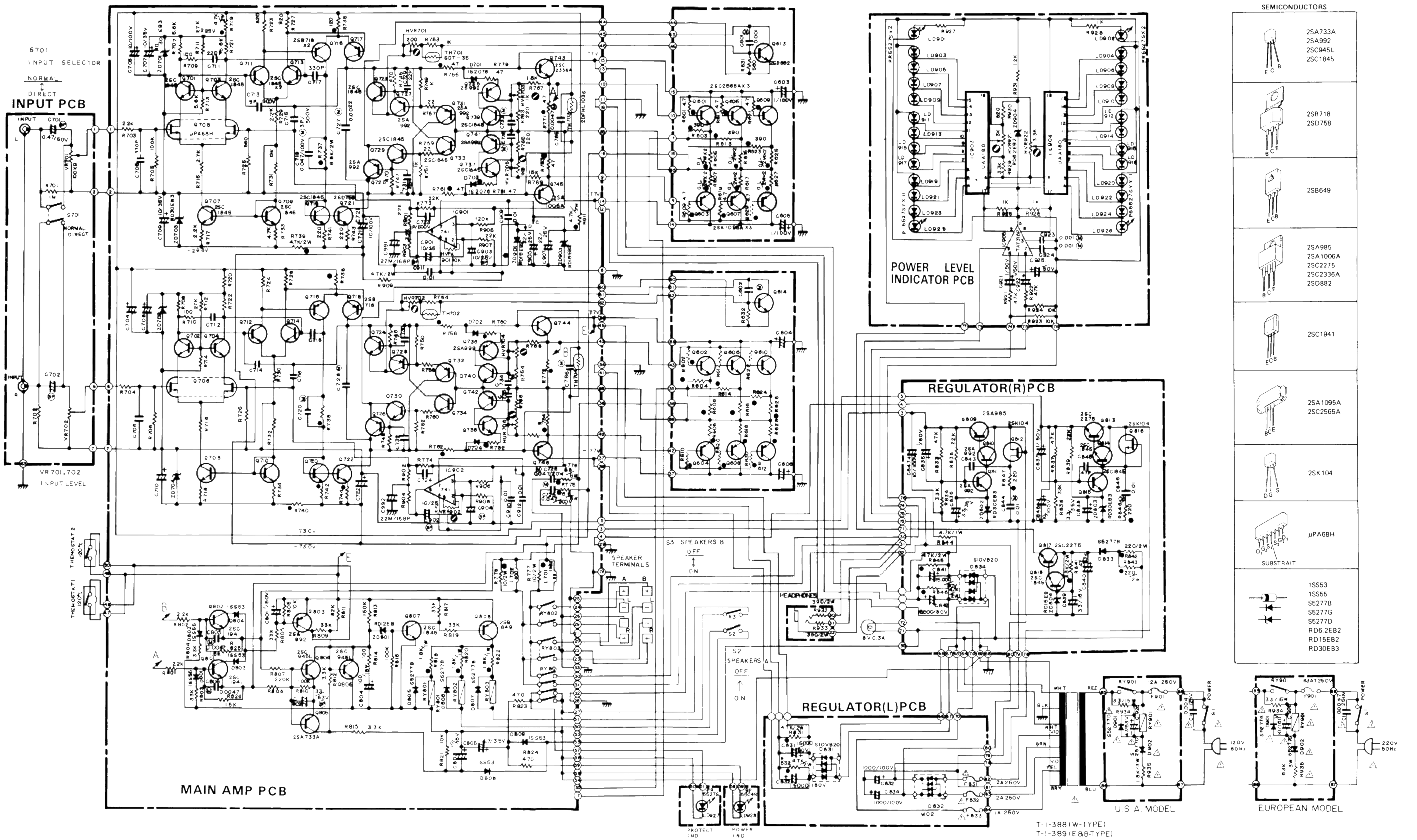
*** PRECAUTIONS DURING SERVICING**

1. Parts identified by the symbol parts are critical for safety. Replace only with same parts number specified.
2. Other parts and assemblies are specified for conformance with such regulations as those applying to spurious radiation. These must also be replaced only with replacements.
   Examples : RF converters, tuner units, RF cables, noise blocking capacitors, noise blocking filters, etc.
3. Use specified internal wiring
   a) Primary leads
   b) Wires covered with PVC tubing
   c) Double insulated wire
4. Use specified insulating materials for hazardous live parts.
   a) Insulation Tape
   b) Insulated Barriers (Spacers)
   c) PVC Tubing
   d) Plastic screws for fixing microswitch (Especially in turntable)
   e) Terminal strips
   When replacing the primary components (transformer, power supply cord, switch, switch by-pass capacitor, etc.), wrap ends of wires securely about the terminals before soldering.
   Where hand soldering is involved a minimum spacing below between terminals of uninsulated live parts of primary or supply circuitry through air or over surface is to be maintained.
   110V, 120V appliance : >3mm spacing
   220V, 240V appliance : >6mm spacing
5. Observe that wires don't contact heat producing parts (heatsinks, oxide metal resistors, rectifiers, etc)
6. Check that replaced wires do not contact sharp edge or pointed parts.
7. Do not remain an electric conductive parts (screws, droplets, etc.) inside the appliance.

* SAFETY RECHECK AFTER SERVICING

Confirm the specified insulation resistance between power plug prongs and externally exposed parts of the appliance is greater than 10MΩ, but for equipment with external antenna terminals (tuner, receiver, etc.) and is specified insulaton resistance should be more than 2M2Ω ({ground terminals, in-output jacks, etc.).

SCHEMATIC DIAGRAM



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

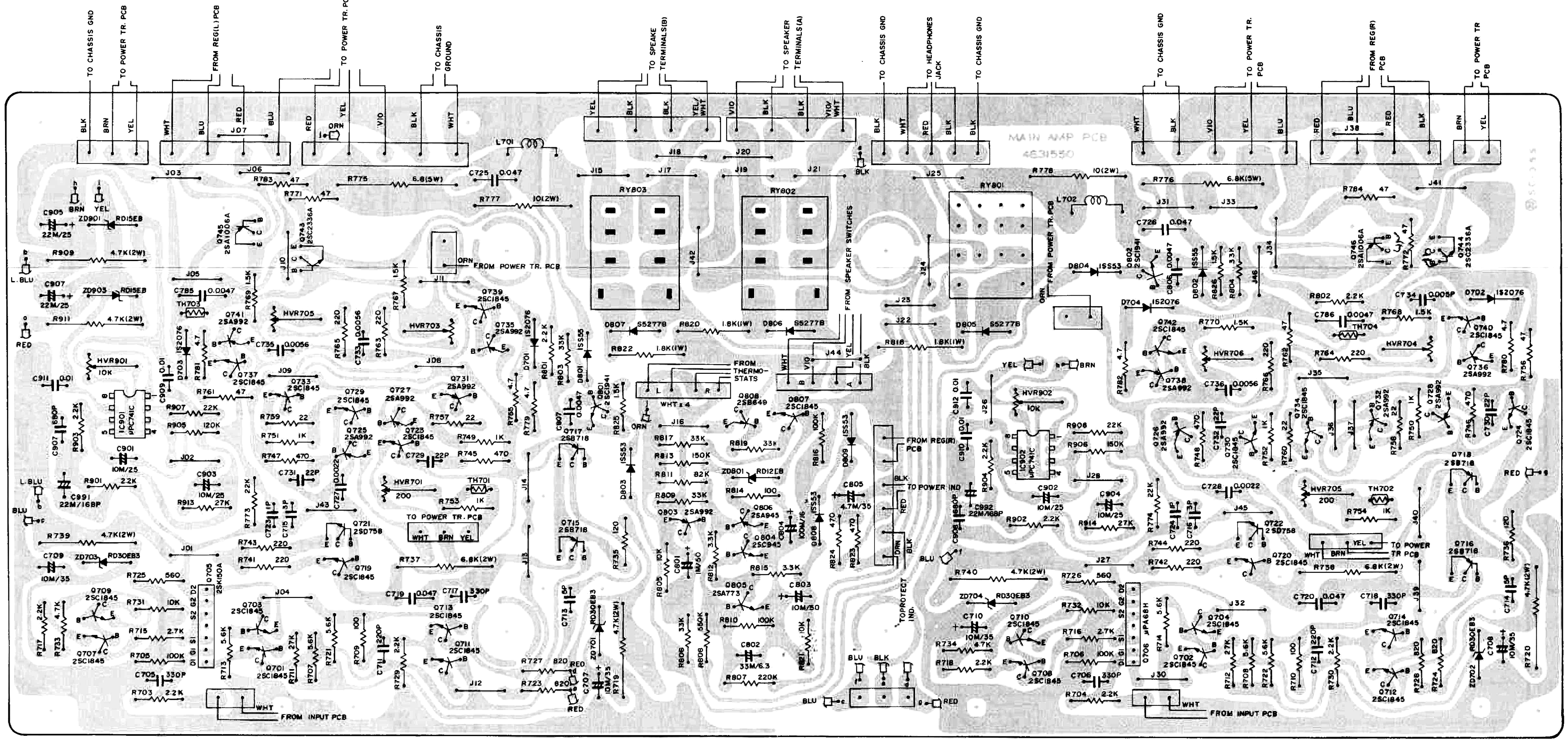
SERVICE INFORMATION:

CAUTION: REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

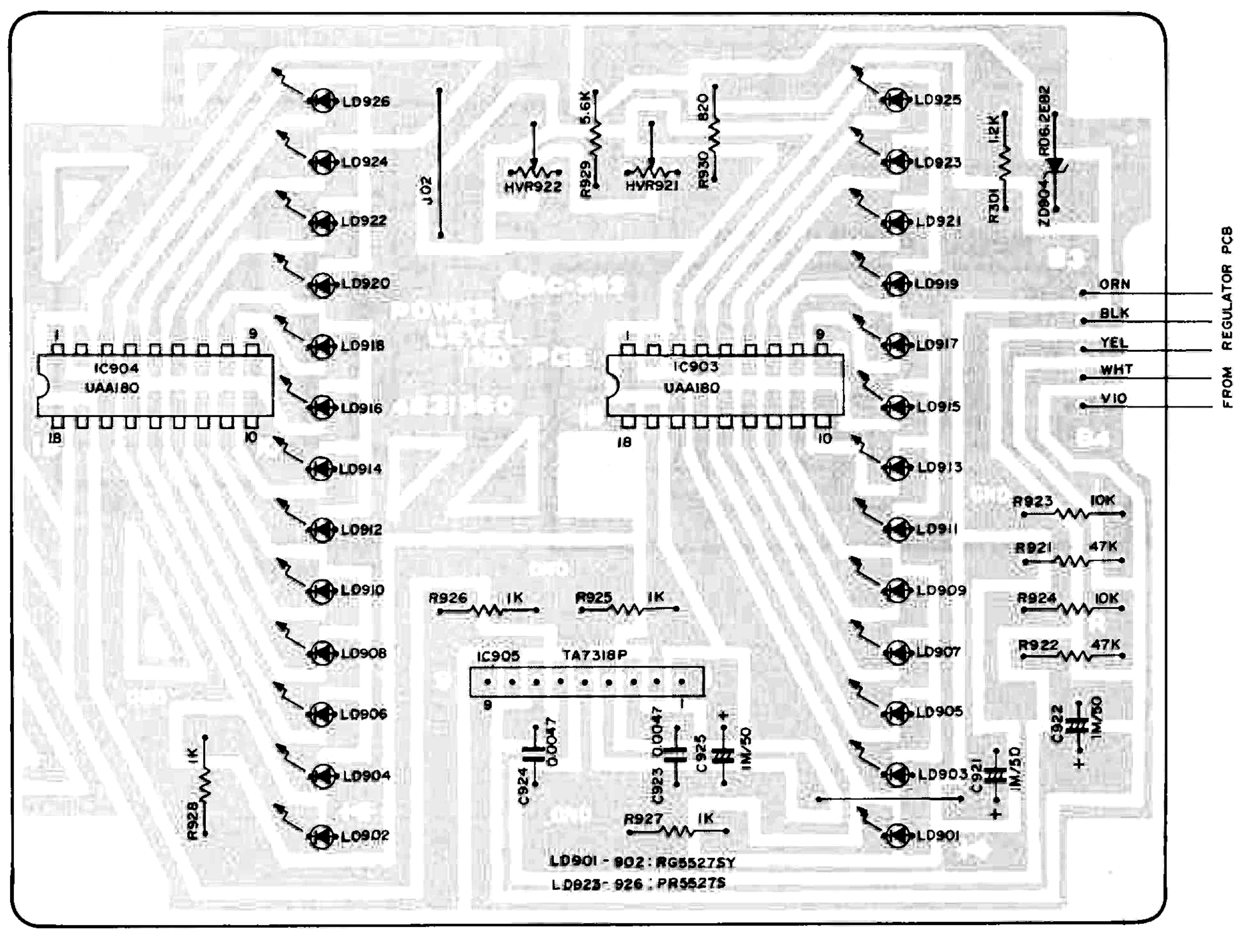
1. EACH PRECAUTION TO BE FOLLOWED DURING SERVICING.
2. ⚠ INDICATES SAFETY CRITICAL COMPONENTS FOR CONTINUED SAFETY. REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.
3. BEFORE RETURNING THIS APPLIANCE TO THE CUSTOMER, YOU MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT.

Figure 7

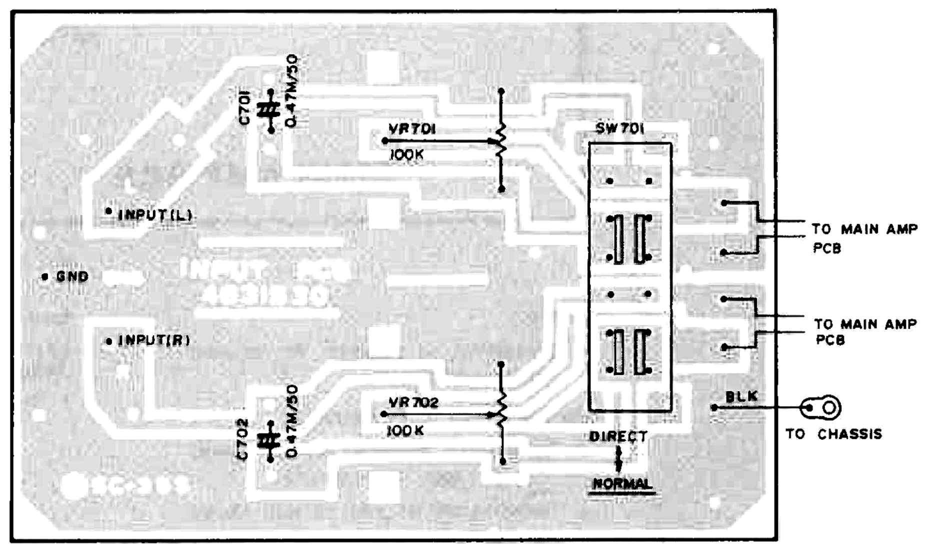
P. C. BOARD (CONDUCTIVE SIDE VIEW) Figure 8



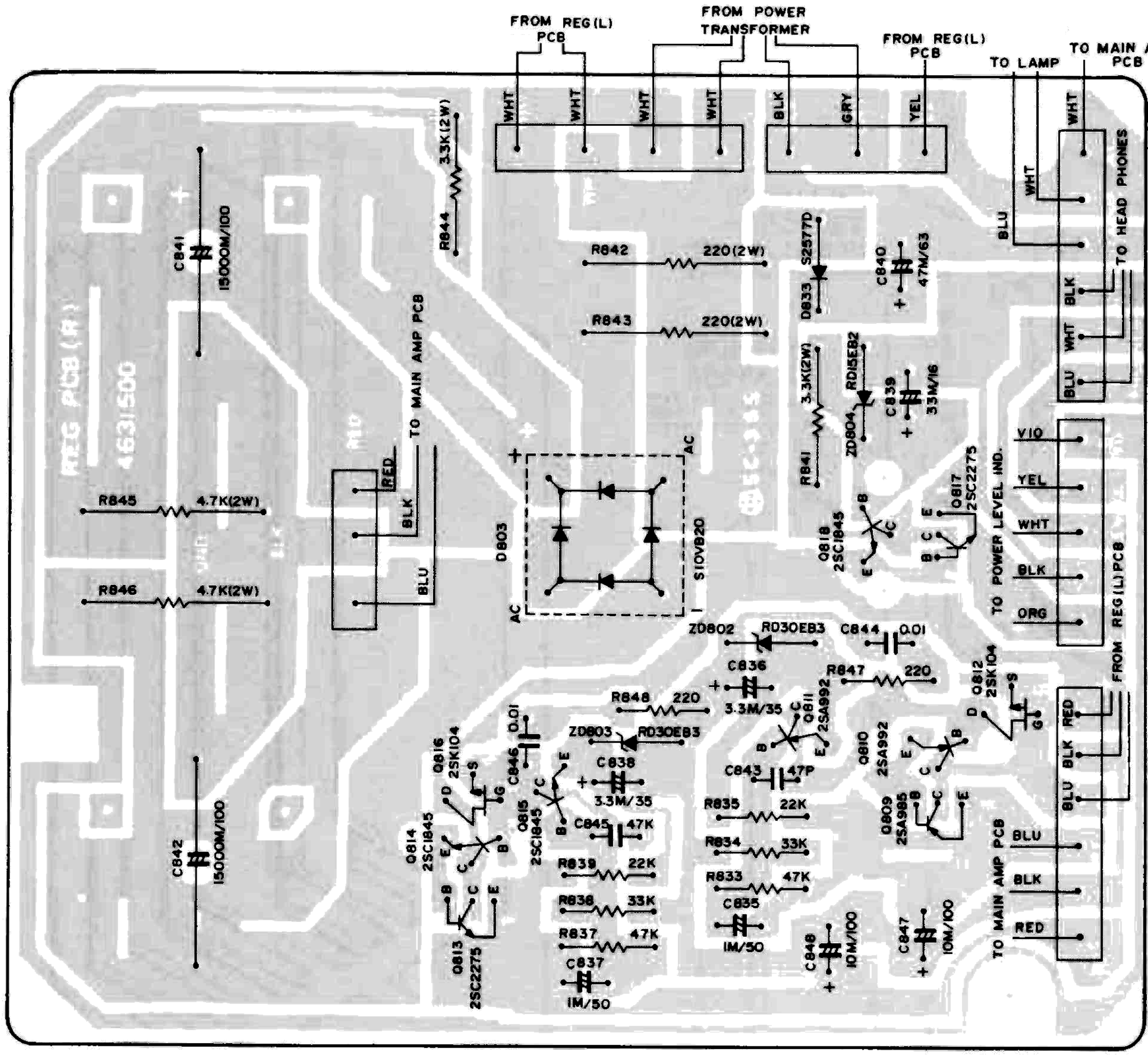
MAIN AMP PCB



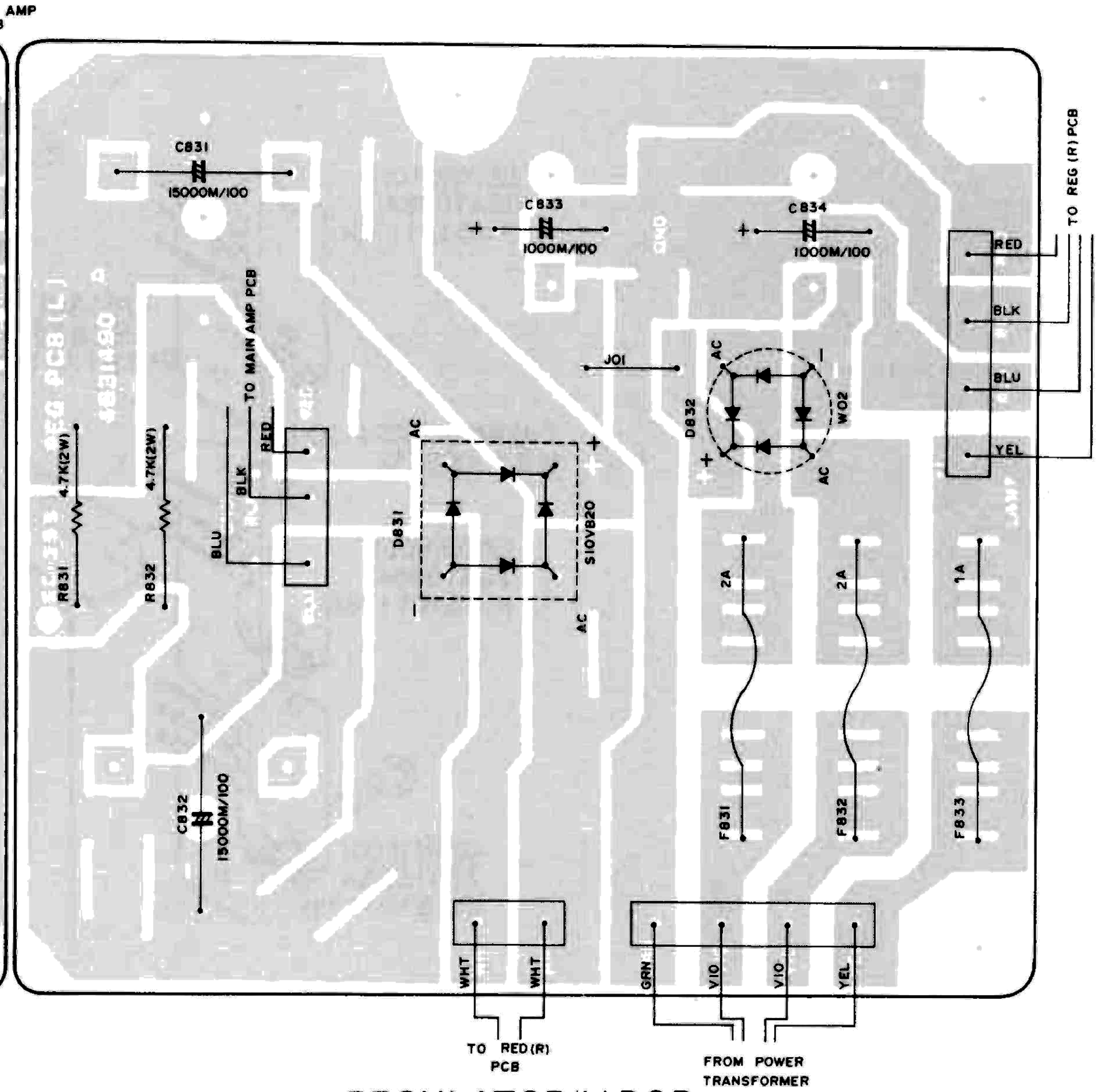
POWER LEVEL IND. PCB



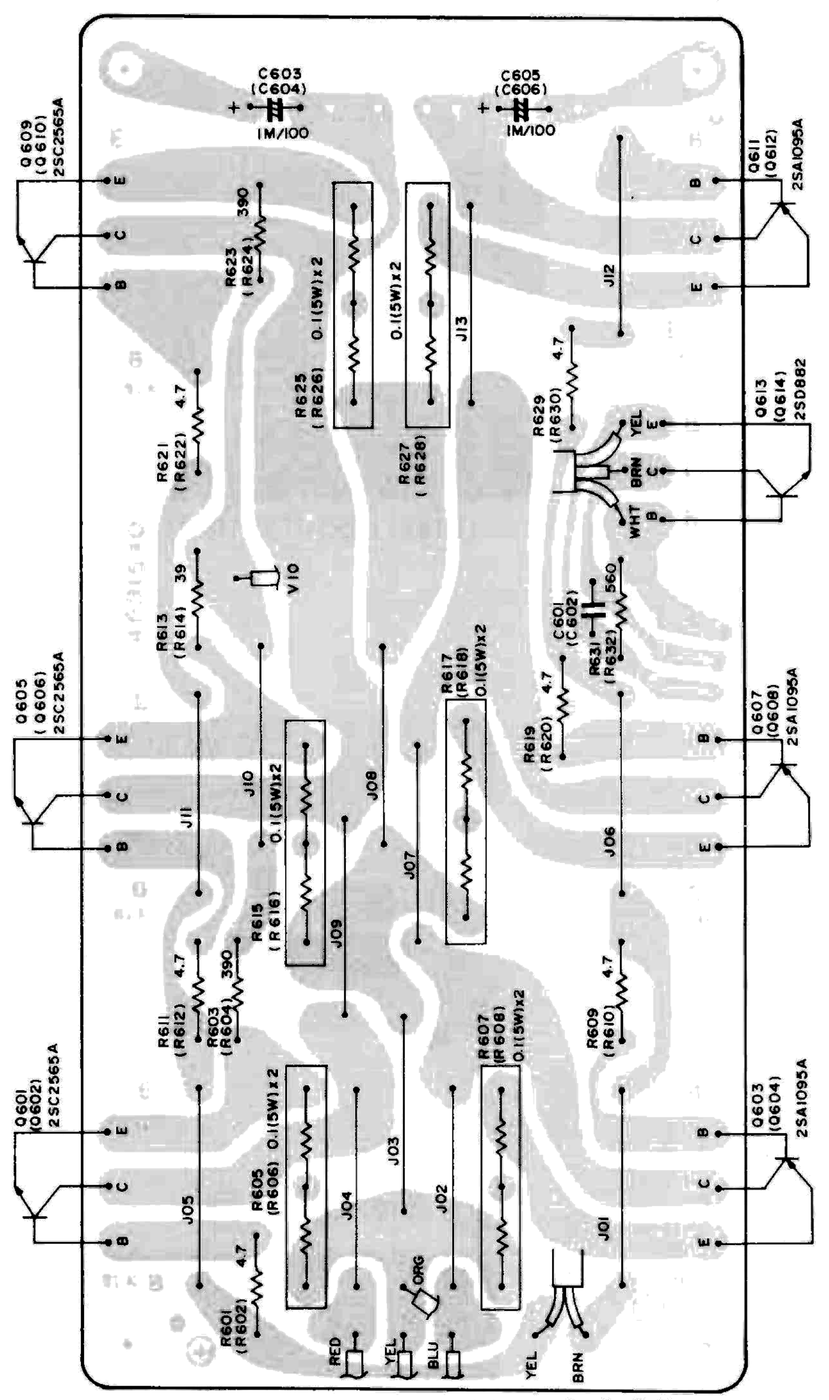
INPUT PCB



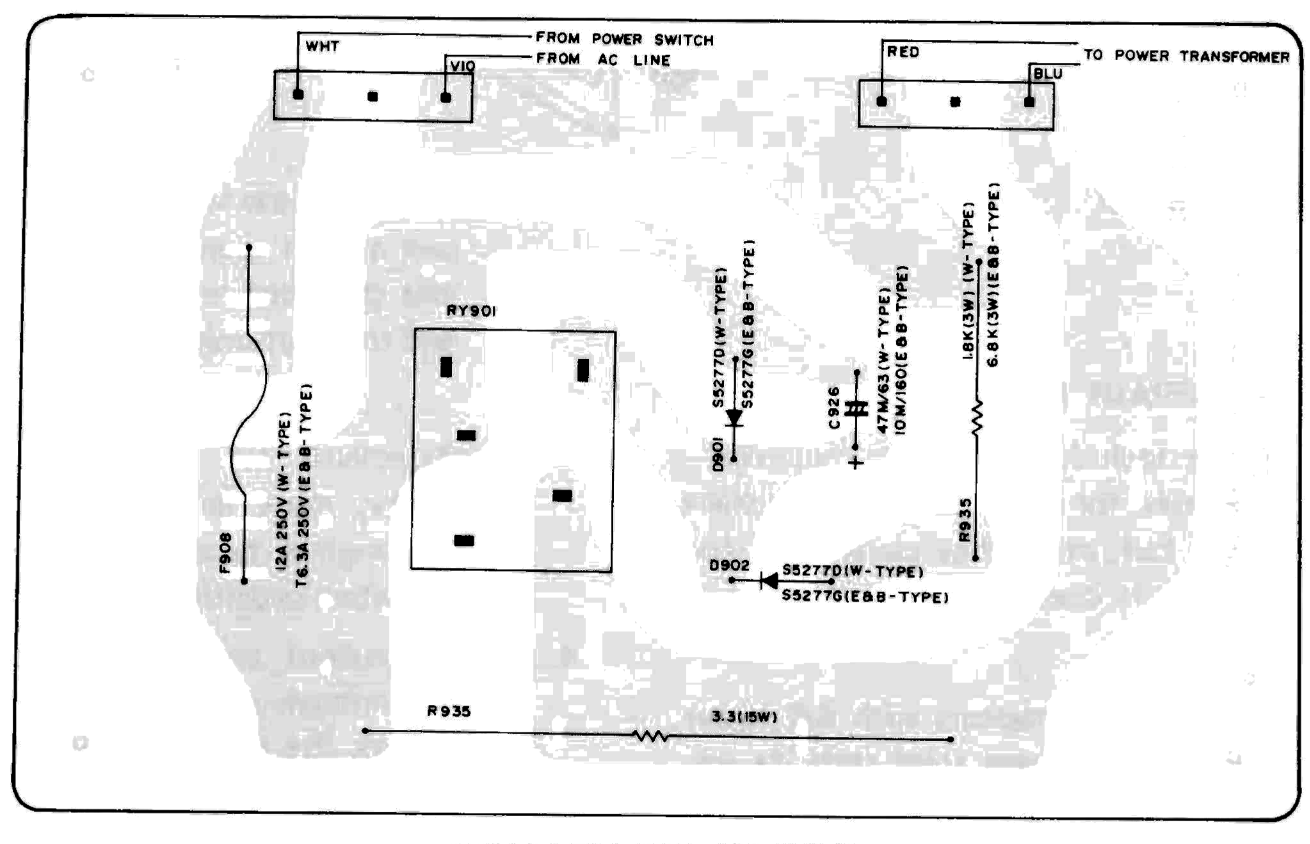
REGULATOR(R) PCB



REGULATOR(L) PCB



POWER TRANSISTORS PCB



PRIMARY RELAY PCB

PARTS LIST

NOTES:

1. ★ The KEY NUMBER (#) marked with a (★) on parts list relate to number of three digits with a (◯). (Photo 6 ~ 9)
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 are 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	9826840
002		2	2	2	Pad	9840960
003		1	1	1	Sack, polyethylen cloth	9640750
004		1	1	1	Sack, polyethylen cloth – #13	9640320
005a		1	–	–	Manual, instructions – English and French	960432E
005b		–	1	1	Manual, instructions – in five different languages	960432K
007a		1	–	–	Card, warranty – U.S.A.	967046A
007b		1	–	–	Card, warranty – Canada	967044A
008		1	–	–	List, service stations	9690300
009		1	1	1	Cord, RCA phono pin plug – 2T-1	962014A
					CABINET ASSEMBLY	
★101a		1	1	1	Panel, front – SILVER	7886540
★101b		1	1	1	Panel, front – BLACK	7886530
★102b		1	1	1	Panel, power level indicator – BLACK	7871320
★103a		2	2	2	Handle – 120G – SILVER	7490360
★103b		2	2	2	Handle – 120B – BLACK	7490210
★104		1	1	1	Window, panel	7803210
★105		1	1	1	Spacer, LED	7002130
★106		1	1	1	Globe, LED – protection indicator	7402540
★107		1	1	1	Guide, button – 1P18 – power switch	7402550
★108		1	1	1	Guide, button – 2P18 – speakers selector	7402560
★109		1	1	1	Globe, LED – input power indicator	7402120
★110a		3	3	3	Button, Push – M18GL – power/speaker, SILVER	7853940
★110b		3	3	3	Button, push – M18BK – power/speaker, BLACK	7852300
★111		1	1	1	Cover, top	7821090
112		1	1	1	Plate, bottom	7326250
★113		4	4	4	Foot, polyethylen – 30φx14	7400780
					CHASSIS ASSEMBLY	
⚠ ★201a		1	–	–	Transformer, power – T-1-388 – AC120V	1103880
⚠ ★201b		–	1	1	Transformer, power – T-1-389 – AC220 or 240V	1103890
⚠ ★202a		1	–	–	Switch, push – ESB-99354T – power	4041830
⚠ ★202b		–	1	1	Switch, push – ESB 90179S – power	4041600
⚠ 203a		1	1	1	C-CAP 0.0047uf	239472A
204		–	1	1	Cover, C-CAP	7400960

KEY NO.	SYMBOL NO.	TYPE+ W	E	B	DESCRIPTION++	PART NO.
★205		1	1	1	Switch, twin push – SUF-24 – speakers	4041040
★207		1	1	1	Light guide, level indicator	7401580
★208		1	1	1	Lamp – 8V 0.3A	5808200
					BACK PLATE ASSEMBLY	
★301a		1	–	–	Plate, back – (W)	7328640
★301b		–	1	1	Plate, back – (E)	732865A
★302		2	2	2	Block, terminal guard	7402130
★303		2	2	2	Knob – P2BK-1613DL – input level	7852350
⚠ ★304a		1	–	–	Cord, AC line – SPT-2	606008A
⚠ ★304b		–	1	–	Cord, AC line – CEE-2T	600511A
⚠ ★304c		–	1	1	Cord, AC line – BS	600515A
⚠ ★305a		1	–	–	Bush, power cord – SR-4N-4	7400690
⚠ ★305b		–	1	1	Bush, power cord – SR-6W-1	7400740
★306		1	1	1	Terminal, speakers – screw type 4P	4450490
★307		1	1	1	Shaft, GND terminal – MK-3	7152050
★308		1	1	1	Nut, GND terminal – MK-2	7152060
					(INPUT PCB SECTION)	
★309		1	1	1	Terminal, RCA phono pin jack	4442070
★310		1	1	1	Switch, slide – SSB-042 – normal-direct selector	4020560
★311		2	2	2	VR 100kohm (B) – input level control	4310630
	C701,702	2	2	2	BP-CAP 0.47uf 50V	225505C
	R701,702	2	2	2	RES 1meg.ohm 5% ¼W	328105J
					PRIMARY RELAY PC BOARD ASSEMBLY	
					(PRIMARY RELAY SECTION)	
⚠	F901	1	–	–	Fuse – 12A 250V MGC	4700750
⚠	F901	–	1	1	Midget fuse – T6.3A 250V	4720490
⚠	RY901	1	–	–	Relay – LY1-0-US TV-5	1700390
⚠	RY901	–	1	1	Relay – FRL-264D100	1700400
⚠	D901,902	2	–	–	Diode S5277D	560047S
⚠	D901,902	–	2	2	Diode S5277G	560069S
⚠	C926	1	–	–	E-CAP 47uf 63V	211625Q
⚠	C926	–	1	1	E-CAP 10uf 160V	261120Q
⚠	C934	1	1	1	CEM-RES 3.3ohm 10% 15W	387338U

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.
⚠	R935	1	–	–	FP-MO-RES 1.8kohm 5% 3W	363182L
⚠	R935	–	1	1	FP-MO-RES 6.8kohm 5% 3W	363682L
					(INPUT POWER INDICATOR SECTION)	
	LD928	1	1	1	LED BR5504S	5060300
		1	1	1	Spacer, LED	7903140
					(PROTECTION INDICATOR SECTION)	
	LD927	1	1	1	LED PR5527S	5060270
		1	1	1	Spacer, LED	7903270
					(HEADPHONES SECTION)	
★401		1	1	1	Jack, headphones	4550260
	R932,933	2	2	2	FP-MO-RES 390ohm 5% 2W	362391L

POWER TRANSISTORS PC BOARD ASSEMBLY – LEFT CHANNEL ONLY

KEY NO.	SYMBOL NO.	TYPE+ W	E	B	DESCRIPTION++	PART NO.
	Q601,605, Q609	3	3	3	TR 2SC2565A (R or O or Y)	512117S
	Q603,607 Q611	3	3	3	TR 2SA1095A (R or O or Y)	510117S
	Q613	1	1	1	TR 2SD882 (P or Q)	513119S
		1	1	1	Thermostat – OHD-120M	490094S
	C603,605	2	2	2	E-CAP 1uf 100V	211810Q
	C601	1	1	1	M-CAP 0.001uf 10% 50V	222102K
	R601,609 R611,619, R621,629	6	6	6	FP-RES 4.7ohm 5% ¼W	328478L
	R603,613, R623	3	3	3	FP-RES 390ohm 5% ¼W	328391L
	R631	1	1	1	RES 560ohm 5% ¼W	328561J
	Others	6	6	6	CEM-RES 0.1ohm 10% 2Wx2	382109P

MAIN AMP PC BOARD ASSEMBLY

KEY NO.	SYMBOL NO.	TYPE+ W	E	B	DESCRIPTION++	PART NO.
	L701,702	1	1	1	Coil, choke – 1uH	1210960
	IC901,902	2	2	2	IC μPC741C	518088S
	Q701 ~ Q704	4	4	4	TR 2SC1845 (E or F)	512115S
	Q705,706	2	2	2	FET μPA68H (L)	516050S
	Q707 ~ Q714	8	8	8	TR 2SC1845 (E or F)	512115S
	Q715 ~ Q718	4	4	4	TR 2SB718 (C)	511117S
	Q719,720	2	2	2	TR 2SC1845 (E or F)	512115S
	Q721,722	2	2	2	TR 2SD758 (C)	513120S
	Q723,724	2	2	2	TR 2SC1845 (E or F)	512115S
	Q725 ~ Q728	4	4	4	TR 2SA992 (E or F)	510110S
	Q729,730	2	2	2	TR 2SC1845 (E or F)	512115S
	Q731,732	2	2	2	TR 2SA992 (E or F)	510110S
	Q733 ~ Q740	6	6	6	TR 2SC1845 (E or F)	512115S
	Q743,744	2	2	2	TR 2SC2336A (P, Q)	512151S
	Q745,746	2	2	2	TR 2SA1006A (P, Q)	510136S
	D701 ~ D704	4	4	4	Diode 1S2076	501019S
	ZD701 ~ ZD704	4	4	4	Zener diode RD30EB3	502066S
	ZD901,902	2	2	2	Zener diode RD15EB2	502050S
	TH701,702	2	2	2	Thermistor SDT-35	5400190

KEY NO.	SYMBOL NO.	TYPE+ W	E	B	DESCRIPTION++	PART NO.
	TH703,704	2	2	2	Thermistor D2FHL-103S	5400180
	C703,704	2	2	2	E-CAP 10uf 100V	211820Q
	C705,706	2	2	2	C-CAP 330p 10% 50V SL	232331K
	C707 ~ C710	4	4	4	E-CAP 10uf 35V	211420Q
	C711,712	2	2	2	C-CAP 220pf 10% 50V SL	232221K
	C713,714	2	2	2	C-CAP 5pf ± 0.5pf 500V SL	234509D
	C715,716	2	2	2	C-CAP 3pf ± 0.5pf 500V SL	237309D
	C717,718	2	2	2	C-CAP 330pf 10% 50V SL	232331K
	C719,720	2	2	2	M-CAP 0.047uf 10% 100V	226473K
	C721,722	2	2	2	E-CAP 10uf 100V	211820Q
	C723,724	2	2	2	C-CAP 1pf ± 0.5pf 500V SL	234109D
	C725,726	2	2	2	M-CAP 0.047uf 10% 200V	272473K
	C727,728	2	2	2	M-CAP 0.0022uf 10% 50V	222222K
	C729 ~ C732	4	4	4	C-CAP 22pf 10% 50V SL	232220K
	C733 ~ C736	4	4	4	M-CAP 0.0056uf 10% 50V	222562K
	C785,786	2	2	2	M-CAP 0.047uf 10% 100V	226473K
	C901 ~ C904	4	4	4	BP-CAP 10uf 25V	215320C
	C905,907	2	2	2	E-CAP 22uf 25V	211322Q
	C909 ~ C912	4	4	4	C-CAP 0.01uf +80, –20% 50V YG	231103Z
	C991,992	1	1	1	BP-CAP 22u 16V	215222C
	HVR701,702	2	2	2	Potentiometer – 200ohm	4301290
	HVR703,704	2	2	2	Potentiometer – 1kohm	4301300
	HVR901,902	2	2	2	Potentiometer – 10kohm	4301280
	R703,704	2	2	2	RES 2.2kohm 5% ¼W	328222J
	R705,706	2	2	2	RES 100kohm 5% ¼W	328104J
	R707,708	2	2	2	RES 5.6kohm 5% ¼W	328562J
	R711 ~ R714	4	4	4	RES 27kohm 5% ¼W	328273J
	R715,716	2	2	2	RES 2.7kohm 5% ¼W	328272J
	R717,718	2	2	2	RES 2.2kohm 5% ¼W	328222J
	R719,720	2	2	2	FP-MO-RES 4.7kohm 5% 2W	362472L
	R721,722	2	2	2	RES 5.6kohm 5% ¼W	328562J
	R723,724	2	2	2	RES 820ohm 5% ¼W	328821J
	R725,726	2	2	2	RES 560ohm 5% ¼W	328561J
	R727,728	2	2	2	RES 820ohm 5% ¼W	328821J
	R729,730	2	2	2	RES 2.2kohm 5% ¼W	328222J
	R731,732	2	2	2	RES 10kohm 5% ¼W	328103J
	R733,734	2	2	2	RES 4.7kohm 5% ¼W	328472J
	R735,736	2	2	2	FP-RES 120ohm 5% ¼W	328121L
	R737,738	2	2	2	FP-MO-RES 6.8kohm 5% 2W	362682L
	R739,740	2	2	2	FP-MO-RES 4.7kohm 5% 2W	362472L
	R741 ~ R744	4	4	4	FP-RES 220ohm 5% ¼W	328221L
	R745 ~ R748	4	4	4	RES 470ohm 5% ¼W	328471J
	R749 ~ R752	4	4	4	RES 1kohm 5% ¼W	328102J
	R755,756	2	2	2	FP-RES 47ohm 5% ¼W	328470L
	R757 ~ R760	4	4	4	RES 22ohm 5% ¼W	328220J
	R761,762	2	2	2	FP-MO-RES 47ohm 5% ¼W	328470L
	R763 ~ R766	4	4	4	RES 220ohm 5% ¼W	328222L
	R767 ~ R770	4	4	4	RES 1.5kohm 5% ¼W	328152J
	R771,772	2	2	2	FP-MO-RES 150ohm 5% 1W	361150L
	R777,778	2	2	2	FP-MO-RES 10ohm 5% 2W	362100L
	R775,776	2	2	2	CEM-RES 6.8ohm 10% 5W	384688K
	R797,798	2	2	2	RES 22kohm 5% ¼W	328223J
	R901 ~ R904	4	4	4	RES 2.2kohm 5% ¼W	328222J
	R905,906	2	2	2	RES 120kohm 5% ¼W	328124J
	R907,908	2	2	2	RES 22kohm 5% ¼W	328223J
	R909,911	2	2	2	FP-MO-RES 4.7kohm 5% 2W	362472L

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.
			(PROTECTOR SECTION)	
	RY801	1 1 1	Relay – DC48V	1700380
	RY802,803	2 2 2	Relay – DC48V	1700330
		4 4 4	Magnet – 1285	7903170
	Q801,802	2 2 2	TR 2SC1941 (L or K)	512112S
	Q803	1 1 1	TR 2SA992 (E or F)	510220S
	Q804,806	2 2 2	TR 2SC945L (P or Q)	515077S
	Q805	1 1 1	TR 2SA733A (P or Q)	514074S
	Q807	1 1 1	TR 2SC2240 (BL)	512116S
	Q808	1 1 1	TR 2SB649 (B or C)	511111S
	D801,802	2 2 2	Diode 1SS55	501024S
	D803,804	2 2 2	Diode 1SS53	501023S
	D805 ~ D807	3 3 3	Diode S5277B	560046S
	D808,809	2 2 2	Diode 1SS53	501023S
	ZD801	1 1 1	Zener diode RD12EB3	502058S
	C801	1 1 1	E-CAP 1uf 50V	211510Q
	C802	1 1 1	BP-CAP 33uf 6.3V	215053C
	C803,804	2 2 2	E-CAP 100uf 16V	211230Q
	C805	1 1 1	E-CAP 10uf 50V	211520Q
	C806	1 1 1	E-CAP 4.7uf 35V	211415Q
			REGULATOR (L) PC BOARD ASSEMBLY	
	F831,832	2 – –	Fuse – 2A 250V MGC	4700620
	F833	1 – –	Fuse – 1A 250V MGC	4700590
	F831,832	– 2 2	Midget fuse – T2A 250V	4720370
	F833	– 1 1	Midget fuse – T1A 250V	4720330
	D831	1 1 1	Diode S10VB20	560058S
	D832	1 1 1	Diode W02	560061S
	C831,832	2 2 2	E-CAP 15000uf 100V	2100100
	C833,834	2 2 2	E-CAP 1000uf 100V	2100110
	R813,832	1 1 1	FP-MO-RES 4.7kohm 5% 2W	362472L
			REGULATOR (R) PC BOARD ASSEMBLY	
	Q809	1 1 1	TR 25A985 (P or Q)	510118S
	Q810,811	2 2 2	TR 2SA992 (E or F)	510110S

KEY NO.	SYMBOL NO.	TYPE+ W E B	DESCRIPTION++	PART NO.
	Q812	1 1 1	FET 2SK104 (F)	516026S
	Q813	1 1 1	TR 2SC2275 (P or Q)	512120S
	Q814,815	2 2 2	TR 2SC1845 (E or F)	512115S
	Q816	1 1 1	FET 2SK104 (F)	516026S
	Q817	1 1 1	TR 2SC2275 (P or Q)	512120S
	Q818	1 1 1	TR 2SC1845 (E or F)	512115S
	D802,803	2 2 2	Zener diode RD30EB3	502066S
	D804	1 1 1	Zener diode RD15EB2	502050S
	D833	1 1 1	Diode S5277B	560046S
	D834	1 1 1	Diode S10VB20	560058S
	C835,837	2 2 2	E-CAP 1uf 50V	211510Q
	C836,837	2 2 2	E-CAP 3.3uf 35V	211413Q
	C839	1 1 1	E-CAP 33uf 16V	211223Q
	C840	1 1 1	E-CAP 47uf 63V	211625Q
	C841,842	2 2 2	E-CAP 15000uf 100V	2100100
	R833,837	1 1 1	RES 47kohm 5% ¼W	328473J
	R834,838	1 1 1	RES 33kohm 5% ¼W	328333J
	R835,839	1 1 1	RES 22kohm 5% ¼W	328223J
	R841	1 1 1	FP-MO-RES 3.3kohm 5% 2W	362332L
	R842,843	2 2 2	FP-MO-RES 220ohm 5% 2W	362221L
	R844	1 1 1	FP-MO-RES 4.7kohm 5% 1W	361472L
	R845,846	2 2 2	FP-MO-RES 4.7kohm 5% 2W	362472L
			POWER LEVEL INDICATOR PCB ASSEMBLY	
	IC903,904	2 2 2	IC UAA180	518066S
	IC905	1 1 1	IC TA7318P	518067S
	ZD904	1 1 1	Zener diode RD6.2EB2	502048S
	LD901 ~ LD922	22 22 22	LED PG5527SY – green	5060280
	LD923 ~ LD926	4 4 4	LED PR5527S – red	5060270
	C921,922	2 2 2	E-CAP 1uf 50V	211510Q
	C923,924	2 2 2	M-CAP 0.0047uf 10% 50V	222472K
	C925	1 1 1	E-CAP 1uf 50V	211510Q
	HVR921,922	2 2 2	Potentiometer – 3kohm	4301340
	R921,922	2 2 2	RES 47kohm 5% ¼W	328473J
	R923,924	2 2 2	RES 10kohm 5% ¼W	328103J
	R925 ~ R928	4 4 4	RES 1kohm 5% ¼W	328102J
	R929	1 1 1	RES 820ohm 5% ¼W	328820J
	R930	1 1 1	RES 3.3kohm 5% ¼W	328322J
	R931	1 1 1	RES 1.2kohm 5% ¼W	328122J

SEMICONDUCTOR DATA

TRANSISTORS

† NOTES

Ge :	Germanium	A :	Alloy	Df :	Drift-field	M :	Mesa
Si :	Sillicon	B :	Base	E :	Epitaxial	P :	Planer
		D :	Diffused	G :	Grown	Pc :	Point-contact
		Dd :	Double-diffused	J :	Junction	Td :	Triple-diffused

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T_A = 25°C unless otherwise specified) Collector-to-Bace Voltage V_{CBO} (V)	Emitter-to-Bace 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
2SA733A (P, Q)	AF, General	PNP Si-E	−60	−5	−100	250	125	−0.1 max.	−60	135 ~ 400	−6	−1	−0.3 max.	−100	−10	450 max.	−6	10	6 max.		NEC
2SA985 (P, Q)	AF, Power, amp.	PNP Si-E	−120	−5	−1.5A	25W (T_c=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	−5	−1	−0.3 max.	−10	−1	100	−6	1	3 max.	Complementary to 2SC1845	NEC
2SA1095A (R, O, Y)	AF, Power amp.	PNP Si-E	−180	−5	−15A	150W (T_c=25°C)	150	−50 max.	−160	55 ~ 240	−5	−1A	−2 max.	−5A	−500	60	−10	−1A*	350	Complementary to 2SC2565A	TOSHIBA
2SB649 (B, C)	AF, Driver	PNP Si-E	−180	−5	1.5A	20W (T_c=25°C)	150	−10 max.	−160	60 ~ 200	−5	−150	−1 max.	−500	−50	140	−5	150*	27		HITACHI
2SA1006A	PA	PNP Si-E	−200	−5.0	−1.5	25W (T_c=25°C)	150	−1	−150	100 ~ 320	−5.0	−150	−0.4	−500	−50	80	−10	−0.1A		Complementary to 2SC2336A	NEC
2SB718 (C)	AF, Driver	PNP Si-E	−200	−5	−50	1250	150	−10 max.	−160	100 ~ 200	−5	−10	−2 max.	−30	−3	140	−5	−10*	5.5	Complementary to 2SD758	HITACHI
2SC945L (P, Q)	AF, General	NPN Si-E	60	5	100	250	125	0.1 max.	60	135 ~ 400	6	1	0.3 max.	100	10	450 max.	6	−10	5 max.		NEC
2SC1845 (E, F)	AF, Low noise	NPN Si-E	120	5	50	500	125	0.05 max.	120	300 ~ 800	6	1	0.3 max.	01	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
2SC2275 (P, Q)	AF, Power amp.	NPN Si-E	120	5	1.5A	25W (T_c=25°C)	150	1 max.	120	100 ~ 320	5	300	2 max.*	1A	100	200	5	200*	19	Complementary to 2SA985	NEC
2SC2565A (R, O, Y)	AF, Power amp.	NPN Si-E	180	5	15A	150W (T_c=25°C)	150	50 max.	160	55 ~ 240	5	1A	2 max.	5A	500	80	10	1A*	200	Complementary to 2SA1095A	TOSHIBA
2SC2336A	PA	NPN Si-E	200	5.0	1.5	25W (T_c=25°C)	150	1.0	150	100 ~ 320	5.0	150	0.3	500	50	95	10	0.1A		Complementary to 2SA1006A	NEC
2SD758 (C)	AF, Driver	NPN Si-E	200	5	50	1250	150	10 max.	160	100 ~ 200	5	10	2 max	30	3	140	5	10*	3.8	Complementary to 2SB718	HITACHI
2SD882 (P, Q)	AF	NPN Si-E	40	5	3A	10W (T_c=25°C)	150	1	30	100 ~ 320	2	20	0.5 max.	2A	200	90	5	−100	45		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	$\|Y_{fs}\|$ (mʊ)	Feed Back Capacitance: Test Conditions	C_{rss} (pF)	Power Gain (Common Source): Test Conditions	G_{PS} (dB)	Noise Figure: Test Conditions	NF (dB)	MANUFACTURER
μPA68H (L)	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 IO (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 VF (V)	Forward Voltage V_{Fmax} (V)	Test Condition IF (mA)	Reverse Current I_{Rmax} (uA)	Test Condition VR (V)	Others	MANUFACTURER
1SS53	Medium speed switching	Si-EP		35	30		300	100	2	200	500			0.8 1.0	1.0 30	0.1	30		NEC
1SS55	Medium speed switching	Si-EP		100	75		300	100	2	200	500			0.8 1.0	1.0 30	0.1	75		NEC
S5277B	Rectifier	Si-DJ		100			2.0A	1.0A	50A	150				1.2	1.0A	10	100		TOSHIBA
S5277D	Rectifier	Si-DJ		200			2.0A	1.0A	50A	150				1.2	1.0A	10	200		TOSHIBA
S5277G	Rectifier	Si-DJ		400			2.0A	1.0A	50A	150				1.2	1.0A	10	400		TOSHIBA
W02	Rectifier	Si-DJ (Bridge)			200	200		1.5A	50	125				1.0	1.0A	10		R_{th} - 50°C/W	GENERAL INSTRUMENT
S10VB -20	Rectifier	Si-DJ (Bridge)		200				10A	200	150				1.05		10			SHINDENGEN
PR -5527S	Lamp (red)	Gap			4		100	I_F=30		85	75			2.5	10	100	4	I_V=1.2 mcd (I_F=10 mA)	STANLEY
PR -5527SY	Lamp (green)	Gap			4		100	I_F=50		85	125			2.5	20	100	4	I_V=8 mcd (I_F=20 mA)	STANLEY
BR -5504S	Lamp (red)	GaAlAS			4		300	I_F=50		85	100			2.0	20	100	4	I_V-80 mcd (I_F=20 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)	V_Z TYP (V)	V_Z MAX (V)	Test Conditions I_Z (mA)	Differential Resistance r_Z TYP (Ω)	r_Z MAX (Ω)	Test Conditions I_Z (mA)	Temperature Coefficient γ_Z TYP (%/°C)	γ_Z MAX (%/°C)	Test Conditions I_Z (mA)	Reverse Current I_Z MAX (μA)	Test Conditions V_R (V)	Others	MANUFACTURER
RD6,2 EB2	Regulator	Si-J	400		175	5.96		6.27	20		20	20				5	3		NEC
RD15-EB2	Regulator	Si-J	400		175	13.89		14.62	10		30	10				2	11		NEC
RD30 EB3	Regulator	Si-J	400		175	28.36		29.82	5		130	5				2	23		NEC

INTEGRATED CIRCUITS μPC741C

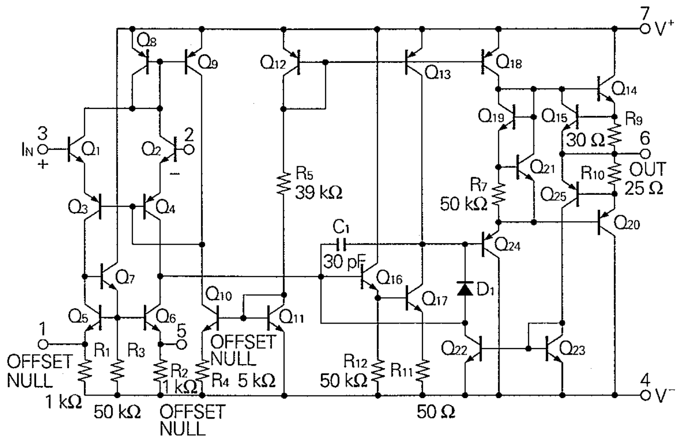
ABSOLUTE MAXIMUM RATINGS

Supply Voltage .... ±18 V	Input Voltage .... ±15 V
Internal Power Dissipation .... 350 mW	Storage Temperature Range ..... −40°C to +125°C
Differential Input Voltage .... ±30 V	Operating Temperature Range ..... −20°C to +75°C

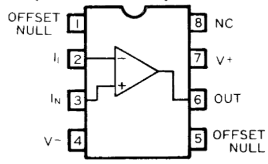
ELECTRICAL CHARACTERISTICS (V_{CC} = ±15V, T_A = +25°C unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage	$R_S \leqslant 10\ k\Omega$		1.0	6.0	mV
Input Offset Current			20	200	nA
Input Bias Current			80	500	nA
Large-Signal Voltage Gain	$R_L \geqslant 2\ k\Omega$, $V_{out} = \pm 10V$	108	106		dB
Output Voltage Swing	$R_L \geqslant 10\ k\Omega$	12	±14		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
Power Consumption			45	85	mW

EQUIVALENT CIRCUIT



TERMINAL GUIDE (TOP VIEW)

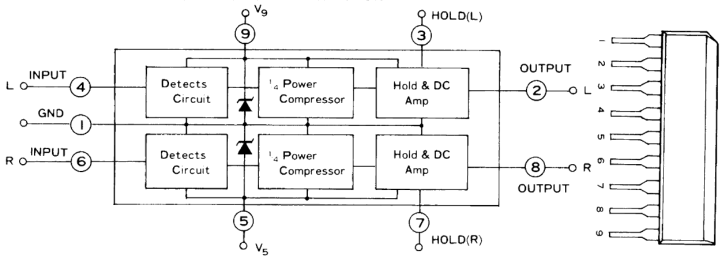


INTEGRATED CIRCUITS TA7318P

FUNCTION/MANUFACTURER

- **Dual Linear-to-Log Converter for Peak Power Indicator/Toshiba**

BLOCK DIAGRAM AND CONNECTION INFORMATION



INTEGRATED CIRCUITS UAA180

FUNCTION/MANUFACTURER

- **Analog-to-Digital Converter; 12 LED Driver/Siemens**

BLOCK DIAGRAM AND CONNECTION INFORMATION