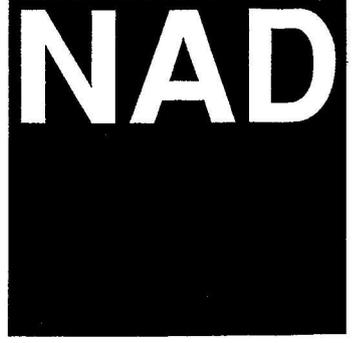


SERVICE MANUAL



208
POWER
AMPLIFIER

208
POWER
AMPLIFIER

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SPECIFICATIONS - NAD 208 STEREO POWER AMPLIFIER

Power Amplifier Section

Stereo Mode

CONTINUOUS AVERAGE POWER 250 W (24 dBW)

OUTPUT INTO 8 OHMS

(Min. power per channel, 20 Hz - 20 kHz, both channels driven, with no more than rated distortion)

Rated distortion 0.03%

(THD 20 Hz - 20 kHz)

Clipping Power 280 W

(maximum continuous power per channel)

IHF dynamic headroom at 8 ohms +4 dB

IHF dynamic power
(maximum short term power per channel)

8 ohms: 600 W (28 dBW)
4 ohms: 750 W (28.7 dBW)
2 ohms: 900 W (29.5 dBW)

Slew rate

Damping factor

(ref. 8 ohms, 50 Hz)

Input impedance

R = 20 kohms

C = 700 pF

100 mV

1.6 V

Input sensitivity for 1 watt out
for rated power

x28.3 (29 dB)

Voltage gain

Frequency response

20 Hz - 20 kHz ± 0.3 dB

-3 dB at 2.5 Hz / 80 kHz

Signal / Noise ratio,
A-weighted

96 dB ref. 1 W

120 dB ref. rated power

THD

(Total Harmonic Distortion, 20 Hz - 20 kHz, from 250 mW to rated output)

< 0.03%

SMPTE I.M.

(Intermodulation Distortion, 60 Hz + 7 kHz, 4:1 from 250 mW to rated output)

< 0.03%

IHF I.M.

(CCIF IM Distortion, 19 + 20 kHz at rated output)

< 0.03%

Bridged (Monophonic) Mode CONTINUOUS AVERAGE POWER OUTPUT INTO 8 OHMS

500 W (27 dBW)

(Min. power 20 Hz - 20kHz, with no more than the rated distortion)

IHF dynamic headroom at 8 ohms +4.7 dB

IHF dynamic power
(maximum short term per channel)

8 ohms: 1500 W (31.7 dBW)

4 ohms: 1800 W (32.5 dBW)

PHYSICAL SPECIFICATIONS

Dimensions Width x Height x Depth

435 x 175 x 370 mm

Net weight

17.3 kg

Shipping weight

19.9 kg

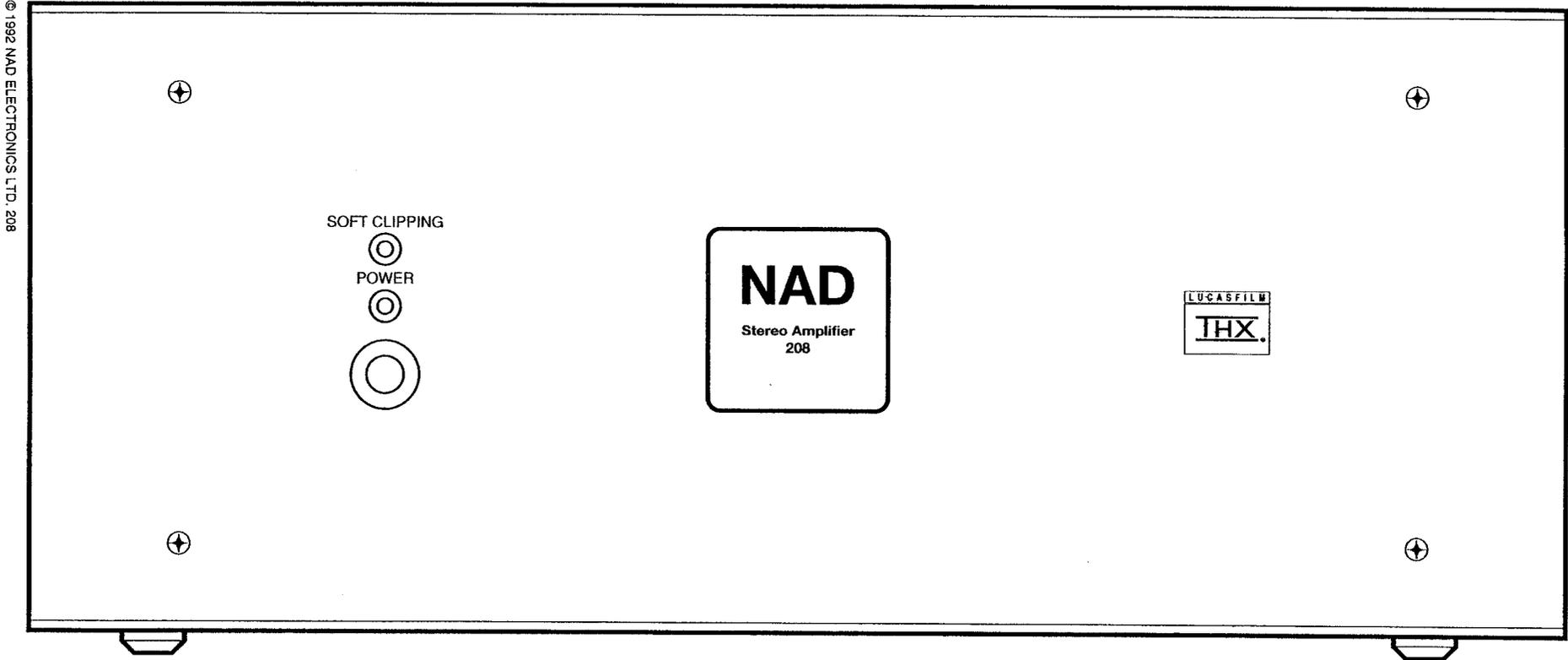
Power consumption at 120, 220 or 240 VAC

1100 VA

Specifications are measured in accordance with EIA Standard RS- 490 (IHF A-202) for amplifiers.

Specifications are those in effect at the time of printing. NAD reserve the right to change specifications or designs at any time without notice.

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REAR PANEL CONNECTIONS

NAD 208

WARNING: TO PREVENT FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

ATTENTION:

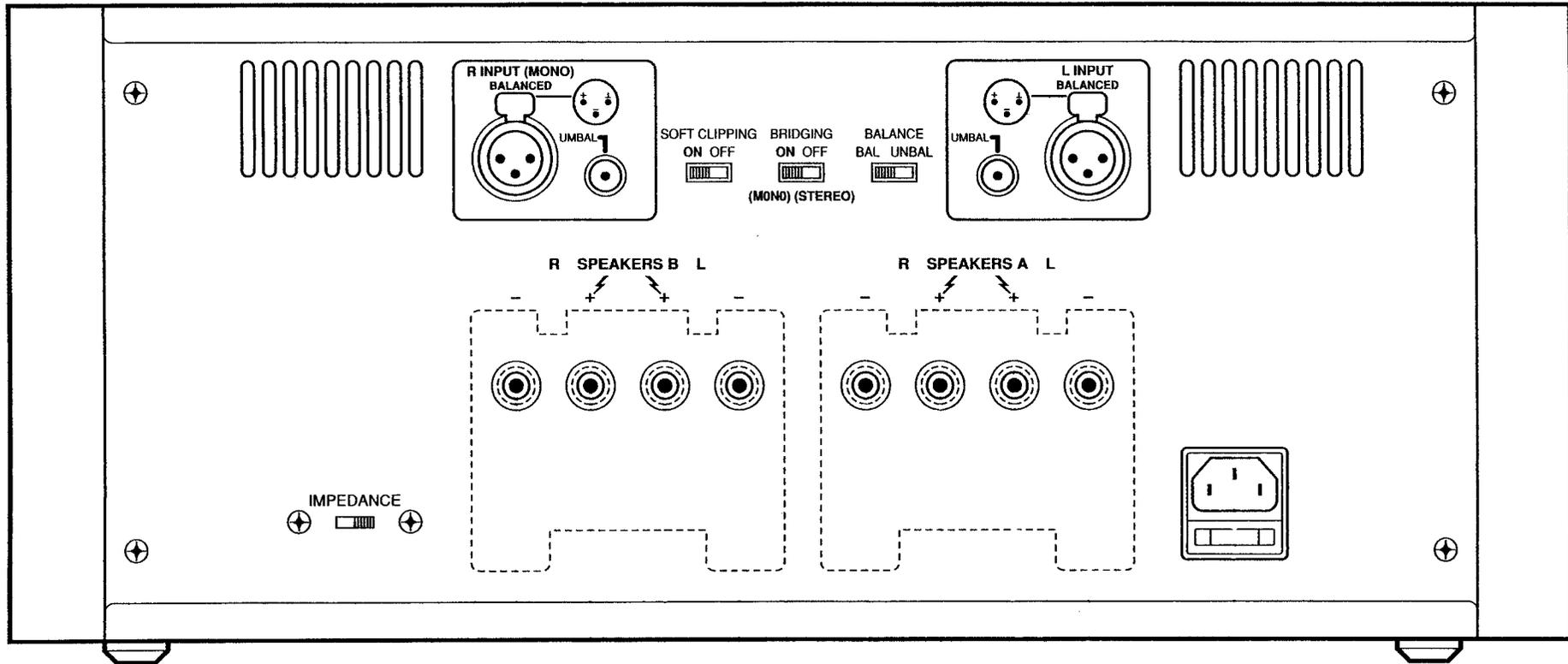
RISQUE DE CHOC ELECTRIQUE
DANS CERTAINS CAS

AFIN D'EVITER UN CHOC ELECTRIQUE ET LES CONSEQUENCES GRAVES QUI POURRAIENT EN RESULTER, TENEZ PAS D'OUVRIR L'APPAREIL ET DE TOUCHER AUX COMPOSANTS INTERNES SANS LA PRESENCE D'UNE PERSONNE QUALIFIEE.



CAUTION

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



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



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

ALIGNMENT DETAILS

A. Idle current.

It is best to reset the idle current when any component is changed in one of the power amplifiers. It is ESSENTIAL to reset the idle current if any of the output or driver or other critical transistors is replaced. When devices have been replaced, always set the idle current to minimum (VR301 fully counter-clockwise on the channel(s) affected) before switching the amplifier on.

A.1 Switch on and allow 5 minutes for the amplifier to warm up. No signal source or load should be connected.

A.2 On the left hand amplifier: Connect a digital voltmeter switched to its 200mV range across R393, 0.1 Ω (clip on to the resistor's leads). TAKE GREAT CARE - high voltages are present.

A.3 Adjust the multi-turn trimmer VR301 to give a reading between 11mV and 13mV.

A.4 Repeat A.2 and A.3 for the right hand amplifier.

B. Common Mode Rejection Ratio (CMRR).

Only make this adjustment if you have reason to believe that the CMRR is below specification, or if you have replaced components in the input amplifier.

B.1 Switch to STEREO mode and BALANCED input. No load resistors are necessary.

B.2 Connect a sine-wave generator to the left XLR input, with the "+" and "-" pins connected together. Set the generator amplitude to about 1 volt RMS and the frequency to 1kHz. Connect an AC voltmeter or oscilloscope to the left channel output terminals.

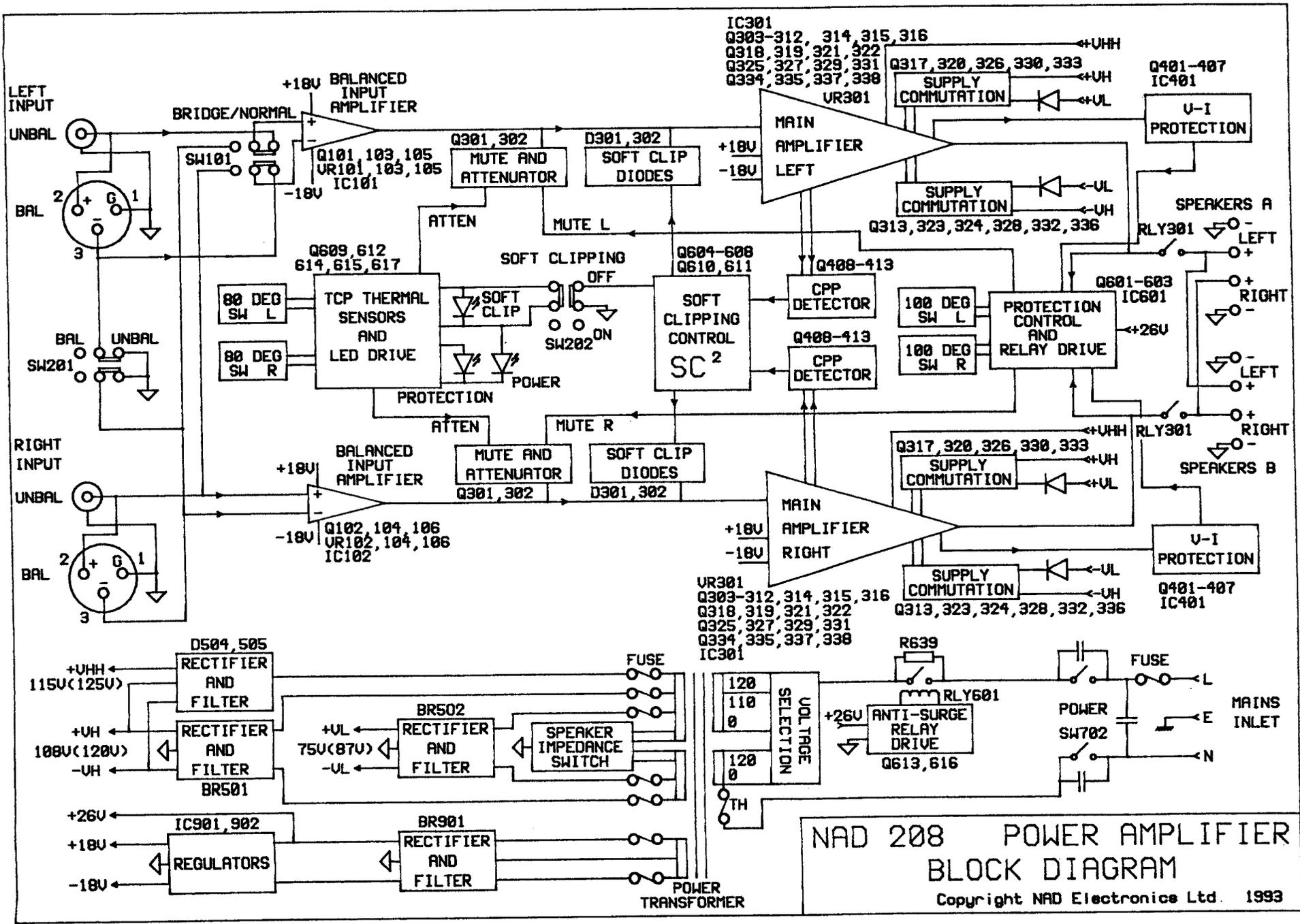
B.3 Adjust trimmer VR105 for minimum output.

B.4 Change the generator frequency to 50Hz and adjust VR101 for minimum output.

B.5 Change the generator frequency to 20kHz and adjust VR103 for minimum output.

B.6 Change the generator frequency to 1kHz and repeat B.3, B.4 and B.5 until no further reduction can be achieved.

B.7 Repeat B.2 through to B.6 for the right channel. The trimmers are VR106, VR102 and VR104 for 1kHz, 50Hz and 20kHz respectively.



NAD 208 POWER AMPLIFIER
 BLOCK DIAGRAM
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CIRCUIT DESCRIPTION

The NAD 208 is a 250 watt power amplifier which uses EDP techniques to achieve an IHF dynamic power output of 600 watts into 8Ω . It has electronically balanced inputs and comprehensive protection systems to guard against abuse while remaining transparent to music signals.

The following circuit description should be read with reference to the accompanying block diagram and schematics.

For the input PCB circuitry only the left hand channel component references will be mentioned (odd numbers). The balanced input signals are fed via coupling capacitors C103, C107 to the differential input stage Q101, Q105. Their collectors drive the output op-amp IC101B, and are supplied from the constant current source Q103. The servo amplifier IC101A controls the DC levels around the input stage using common mode feedback. Overall differential feedback is provided by the network R133, R129, R117, R111, R121 and VR105, which fixes the input stage gain at exactly 2.0. The Common Mode Rejection Ratio (CMRR) is trimmed by three preset resistors. VR105 sets the mid-band CMRR (around 1kHz), VR101 the low frequency CMRR (50-60Hz) and VR103 the high frequency CMRR (20kHz). Clipping diodes D101, D103 protect against excessive common mode input signals.

The inputs can be unbalanced with SW201, which grounds the inverting inputs to minimize noise. In bridge mode SW101 disconnects the left channel input amplifier and re-connects it, in reverse phase, to the right channel input connectors. Thus in bridge mode the input impedance is halved, but the voltage gain is doubled.

R206 and C206 provide a low impedance return from signal ground to the amplifier chassis. The chassis is taken to mains earth via the third wire of the three-core power cord.

The left and right signals are taken from the input PCB via two screened cables, to each of the main power amplifier PCBs. These two PCBs are *identical* and so have the same component reference numbering.

The input resistors R303 and R307 act with C305 to provide RF filtering. R303 also contributes a suitable source impedance against which the soft clip diodes D301 and D302, the input mute transistor Q301 and input attenuator Q302 and R304, can work. The signal splits through C306, C307 to feed the input transistors Q304, Q305 which form a complementary current-mode feedback pair. The output signals from their collectors pass via the cascode transistors Q303, Q306 to the twin current mirrors R319, D306, Q308, R334 and R322, D307, Q311, R335, R336 which form the push-pull class A gain stage.

A temperature-compensated DC bias voltage for the output stage is produced by the network Q309, Q310, D308, R330-R333, VR301. Q309 is thermally coupled to the pre-drivers Q314, Q316 and the distortion correction transistor Q315 to compensate for their temperature drift. Q310 is mounted on the main heatsink to compensate for V_{gs} drift in the output MOSFETs.

The positive pre-driver Q314 feeds via R340 and D313 to the positive push-pull drivers Q321, Q322. These in turn drive the four paralleled main positive output MOSFETs Q327, Q331, Q335, Q338. Resistors R370, R378, R386, R394 force the output current to be shared equally between the output MOSFETs (**). D317 clamps the MOSFET gate drive to limit the positive peak current output to a safe level.

** Although current sharing resistors are used, each set of paralleled MOSFETs (output and EDP) must be matched very closely in order to achieve accurate current sharing. It is therefore MOST IMPORTANT that only matched sets of spare parts supplied by NAD are used for replacing these MOSFETs. If a single MOSFET fails, then the whole parallel set of three or four MUST be replaced.

On the negative side, the pre-driver Q316 feeds the negative push-pull drivers Q318, Q319 which drive the four negative main output MOSFETs Q325, Q329, Q334, Q337 and their current-sharing resistors R367, R375, R389, R392. The bias voltage for Q318 and Q319 is provided by R357 and D322, D323 and they also act to clamp the MOSFET gate drive to limit the negative peak current output to a safe level.

The distortion correction transistor Q315 senses the difference between the output signal (via D314, C326, R345, C323) and the signal on Q316's emitter, amplifies the error and feeds it back by driving a correction current through R340 and R342. Q307 and Q312 prevent excessive currents being drawn when the amplifier is driven into negative clipping. This configuration is covered by NAD patents.

The main outputs are fed from the low voltage supply rails $\pm V_L$ via the commutation diodes D326, D327. Above the commutation level, the current for the main outputs is drawn via the EDP MOSFETs from the $\pm V_H$ supplies. V_L is typically 75V in 4 Ω mode and 87V in 8 Ω mode. V_H is typically 108V in 4 Ω mode and 120V in 8 Ω mode.

The drive for the EDP MOSFETs is taken from the collector of Q308 and buffered by Q317 and Q320. A positive offset voltage is applied by D319 biased through R353 to drive the positive EDP MOSFETs Q326, Q330, Q333 with their current sharing resistors R369, R377, R385. The arrangement acts as a voltage follower so that, above commutation, the voltage on Q335's drain follows the signal on Q317's base (and hence the output signal) but displaced about 20 volts above the latter. D324 prevents reverse bias of the MOSFET gates and D325 limits the maximum drain current.

The negative EDP circuit achieves the same end, but in a different way to suit the quasi-complementary N-channel design. The signal on the emitter of Q320 is further buffered by Q313 and fed via the offset zener diode D316 and D318, C325, R355, R356 to the base of Q324. D323, Q323, Q234 and the MOSFETs Q328, Q332, Q336 act in the same way as a conventional complementary feedback pair. The result is that the voltage on the drain of Q336 etc. follows accurately that on the base of Q324 (plus an offset voltage). Q324's emitter is biased up 15 volts by Q323 and D323 in order to ensure that the MOSFETs can be driven into saturation on negative peaks. D318 prevents reverse bias of Q324's base-emitter junction and D323 limits the maximum drain current.

On the positive side, all the high-level, low-current stages (i.e. everything apart from the output MOSFETs) are fed from an extra +V_{HH} supply which is about 6 volts higher than +V_H. This extra voltage is necessary to ensure that the output and EDP MOSFETs can all be driven into positive saturation.

Some AC feedback is taken direct from the output MOSFETs via R327 to the feedback point on R326. The major part, however, is taken after the output relay RLY301 via R325. Both of these feedback resistors are 5 watt rated precision metal film types. The value of resistor R324 is set on production test to fix the total amplifier gain at precisely 29dB. A DC feedback servo ensures a very low output offset voltage and this comprises IC301, R314, R315, R318, R328, R329, C312, C313, C317. IC301 is fed from the $\pm 18V$ supplies via R302 and R308 (decoupled by C304, C308) which drop the voltage to typically $\pm 13.5V$ to be safely within the op-amp's rating.

Protection against short circuits and load faults is provided using a sophisticated analogue computer which calculates the junction temperature of the output MOSFETs with separate detectors for the positive and negative sides.

On the positive side, D402, R404, Q403 sense the voltage across Q338 and convert this to a current through R405 and hence D407. D401, R401, Q401, R402 sense the voltage across (and hence the current through) R394 and convert this to a smaller current through D403 and R406. These current signals feed into the transconductance amplifier IC401a which is configured as an analogue multiplier. The output current from IC101a, proportional to the instantaneous power dissipated in the positive output MOSFETs, flows through the R-C network C401, R420, C403, R422, C405, R424 to

ground. This network mimics the thermal time constants between the output MOSFET's case temperature and junction temperature. The voltage developed across the network is sensed by Q406 which switches on when excessive power is dissipated. By thermally coupling Q406 to the case of one of the MOSFETs (Q327), and applying an offset bias current through R418, the switching threshold of Q406 can be made to track quite accurately just inside the maximum rated junction temperature for the MOSFETs.

The negative side sensing is slightly different because the MOSFET current is sensed across R389, R393. This is done by D405, Q404, R410, with a bias current applied via R407. The collector current is fed from Q404's collector via R409 and current mirror D406, R408, Q405, R411 to produce a current into IC101b pin 16. The resistor values are arranged so that the scaling factor is the same as for the positive side. Voltage sensing is carried out by Q402, R403 and the resulting current fed to IC101b via D404. The output from IC101b is configured exactly as IC101a to drive the thermal sense transistor Q407, coupled to output MOSFET Q325. The two sense transistors Q406, Q407 have their collectors connected together and drive the protection relay driver IC601 via R604, R603, Q601, R607. These last devices are all mounted on the power supply PCB.

The last circuit on the power amplifier PCB is the voltage and current detector for the CPP (Continuous Power Protection) system. Q408, Q409, R427, R428, R431, Q410 sense the voltage across (and hence the current through) R389, R393 and convert this to a smaller current at Q410's collector. Q408, Q409 are biased from the current source Q412, Q413, R438, R439, R426. Q410's output current is fed via R430 to the current mirror D408, R429, Q411, R433 which is powered from +18V and generates a voltage across R434 which is proportional to the amplifier's output current. Similarly, R432, D409 generate a voltage across R437 which is proportional to the amplifier's output voltage. These two voltages are summed by R435, R436 and then averaged by C608 which is mounted on the power supply PCB.

Moving on to the power supply PCB we find Q610 which senses the voltage across C608 and starts to conduct if this exceeds approximately 600mV. Q611 and C609 serve the same function for the right hand channel. The collectors of Q610 and Q611 are connected together so that either or both channels can control the following SC² (Soft Clipping Control) system. The SC² circuit comprises Q604-Q608 and their associated bias components. Q606 buffers the DC control signal from Q610, Q611. The signal is further buffered by R626, R625 and Q604 to produce the positive soft clip voltage. The same signal is inverted by R628, D604, D605, Q608, R629, R630, Q607 and buffered again by R627, R624 and Q605 to produce the negative soft clip voltage. These two control voltages are fed to both power amplifier PCBs to drive the soft-clip diodes D301, D302 already mentioned. The action of this circuit is such that, if the amplifier's output exceeds a certain threshold level, the soft-clip control voltages are reduced to prevent any further increase in output. The averaging time constant of C608, C609 (≈ 2.3 seconds) ensures that the circuit ignores all music signals, but responds quite quickly to continuous test signals such as sine-waves. The various component values are chosen to set the amplifier's 1kHz clipping level for continuous sine-waves with both channels driven to approximately 280-290 watts into 8 Ω and the same into 4 Ω .

The SC² circuit is also used for two other functions. The normal Soft Clip function can be engaged using SW202. This connects R633 from Q606's base to ground and, at the same time removes the short circuit across the Soft Clip LED D801 allowing it to light with current from R635. D608, R636, R634, R632 produce the correct soft clip level in conjunction with R633. They are fed from +VHH which ensures that the soft clip level tracks changes in supply voltage caused by line or load variations.

The last function of the SC² circuit is to implement the first stage of TCP (Thermally Controlled Protection). If the temperature of either heatsink exceeds 80°C then one of the two thermal switches SW301 will open causing Q612 to switch off and Q614 to switch on. When Q614 switches on it connects R646 to ground and brings the soft clip control voltages down to a much lower level than with SW202/R633. This level is set so that the amplifier's output cannot swing far enough positive or

negative for the EDP circuits to turn on and connect the outputs to the high voltage supplies. Thus all the output current is constrained to be drawn from $\pm VL$ which reduces the stress on the transformer and output devices. At the same time, Q615 and Q617 are also switched on, which engages the input attenuators (Q301, R304) on each power amplifier PCB to reduce the output level by about 4dB. This prevents any gross clipping being introduced, even if the amplifier was already being over-driven. When the thermal trips open and Q612 switches off, it allows current to pass through the red half of D802, the POWER/protection LED, which then glows amber to indicate that this first mode of protection has been engaged. CPP, SC² and TCP are all covered by NAD patents or pending patents.

The ultimate protection, both for the amplifier and loudspeakers, is provided by the speaker output relays. These are controlled by IC601. Apart from opening the relays on signals from the V-I protection circuit as already explained, IC601 has two other "fault" sources. First it senses the DC level on the output of each power amplifier via R601, R602, R605, R606, C602, C603 and opens the relays if the average DC becomes excessive. Secondly it provides muting at switch-on / switch-off. The "ON" condition is sensed via D602, which rectifies the low voltage AC and charges C606 negatively. At switch-on, the relays remain open until the voltage across C606 has gone sufficiently negative to pull down IC601 pin 1. At switch-off, C606 discharges rapidly through R619, D607 and causes the relays to open very quickly. The second stage of TCP is effected by the two 100° C thermal trips SW302 which are connected in series with the output relays. If either heatsink exceeds this temperature, then the relays open. At the same time, Q602 is turned on via R615, R616, thus turning on Q603 which in turn switches on the mute transistors on each power amplifier PCB (Q302). As these transistors switch much faster than the relay's contacts, they will remove the output signal a millisecond or two before the relay contacts open. This prevents arcing and erosion of the relay contacts which can lead to increased contact resistance and ultimate failure. When Q603 switches on it also turns on Q609 which shorts out the green half of D802, the POWER/protection LED. Q609 also pulls down D606 which switches off Q612 allowing current to flow through the red half of D802. Thus, whenever the output relays open, the POWER LED will glow red - whatever the condition of the other protection systems.

The supplies for the main power amplifiers are located in the centre of the power supply PCB. The low voltage (56/65Vac) transformer taps are fed via 10A anti-surge fuses F501, F503 to the bridge rectifier BR502. This feeds two banks of four 4,700 μ F/100V reservoir capacitors C501, C502, C503, C504, C508, C509, C513, C514 providing the $\pm VL$ supplies. The high voltage (80.5/89.5Vac) transformer taps are fed via 10A anti- surge fuses F502, F504 to the bridge rectifier BR501. This feeds two banks of three 10,000 μ F/50V reservoir capacitors C505, C506, C510, C511, C515, C516 providing the $\pm VH$ supplies. Finally, the highest voltage tap (101/110Vac) is taken via a 250mA anti-surge fuse F505, R501 and rectifier D504 to 4,700 μ F/16V reservoir capacitors C507, C512 providing the +VHH supply. F505 is also taken via D505, R502 to the- VH supply in order to balance the current drawn from this transformer tap. D501, D502, D503 prevent excessive forward or reverse voltages from appearing across the VH or VHH reservoir capacitors under fault conditions.

A separate 21-0-21 volt winding is used to power the $\pm 18V$ regulators. This winding is fed via BR901 to the reservoir capacitors C905, C906. The positive unregulated voltage is used to power the speaker output and switch-on delay relays RLY301 \times 2 and RLY601. IC901 and IC 902, together with their associated components R901-904, C901-904 produce the low noise regulated $\pm 18V$ supplies.

The primary side of the transformer has two windings, one 0- 120V and one 0-110-120V. These are taken to the power supply PCB where the mains voltage can be set for 120V, 230V or 240V by means of wire jumpers. The incoming mains voltage is connected via a detachable mains cord to an IEC standard 3- pin inlet, which has a primary fuseholder built in on the live side. This contains the primary fuse F701 (6.3AT for 230 or 240V, 10AT for 120V) and also a spare fuse in its own compartment. This connector is wired to the two-pole power switch SW701 which is fitted with arc-suppression capacitors C701, C702.

The neutral side of SW701 is fed direct to the transformer, but the live side goes via the above-mentioned primary voltage jumpers to the switch-on delay circuit. At switch-on the relay RLY601 has its contacts open, leaving R639 connected between the mains live and the transformer. R639 is a sufficiently low resistance that the amplifier can power up normally (with no output signal because the output relays are open), but it limits the peak switch-on surge current to below about 50A at 240V or 33A at 120V. Once the amplifier has been switched on, C610 begins to charge up via R644. When the voltage across C610 reaches about 6 to 7 volts, Q616 switches on via R647, R648 and turns on the relay RLY601, closing its contacts, thus making a low resistance path from SW701 to the transformer. This switch on delay is less than half a second.

While the amplifier is switched on, Q613 is held off by the negative potential on C606 (via R619). When the amplifier is switched off, the rapid discharge of C606 allows R637 to turn Q613 on, which in turn discharges C610 very quickly via R641. Thus the switch-on delay circuit is reset very rapidly at switch-off so that no harm can be done if the amplifier is switched on again immediately.

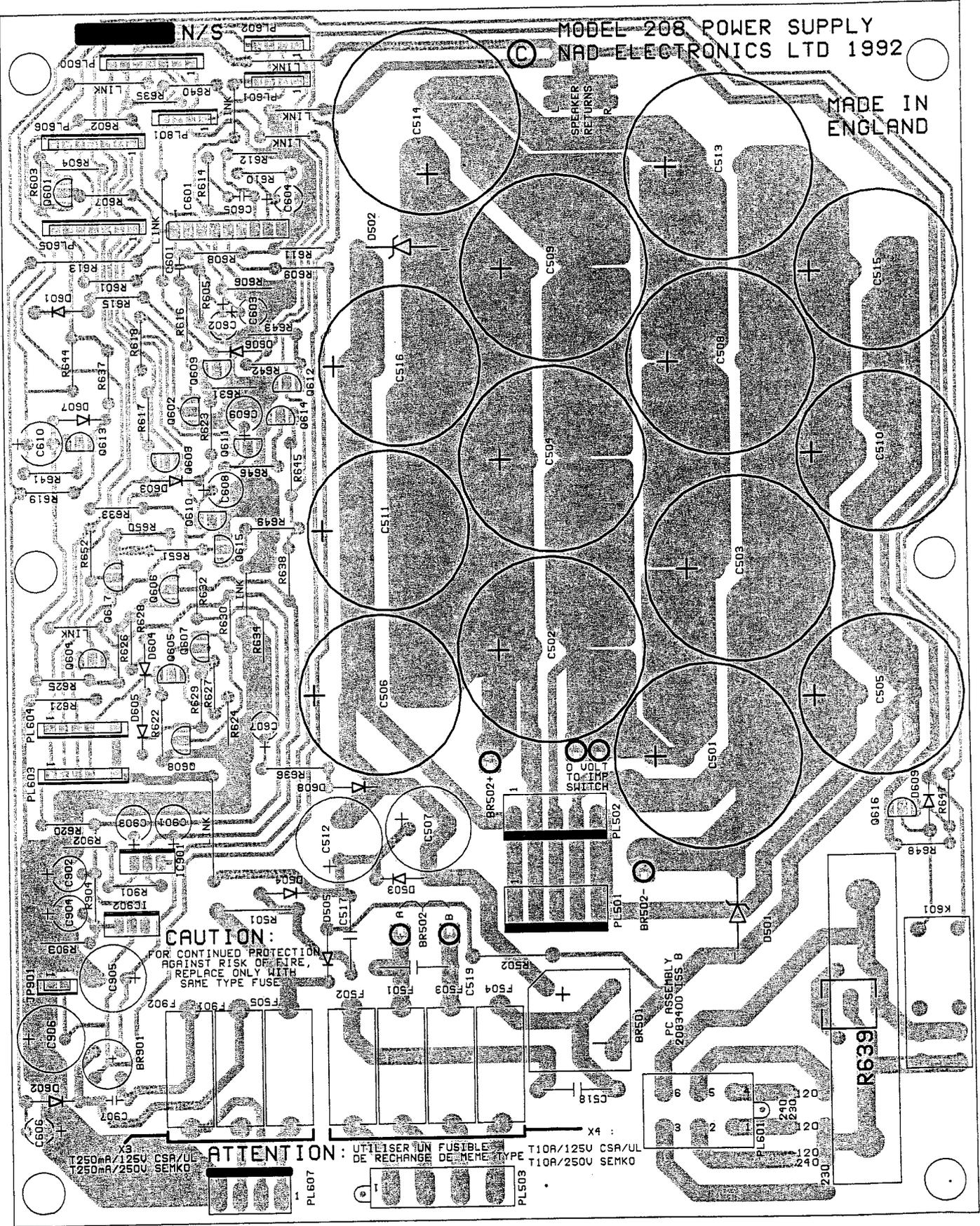
NOTE

230 V and 240V models - B, B1 and C versions

Later units have a new power transformer fitted which renders the power - on delay circuit unnecessary. RLY601 and its associated components R637, R639, R641, R644, R647, R648, C610, D607, D609, Q613 and Q616 are therefore deleted. Wire jumpers are connected in place of the relay contacts and D607.

MODEL 208 POWER SUPPLY
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MADE IN ENGLAND

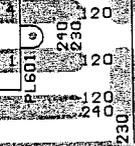


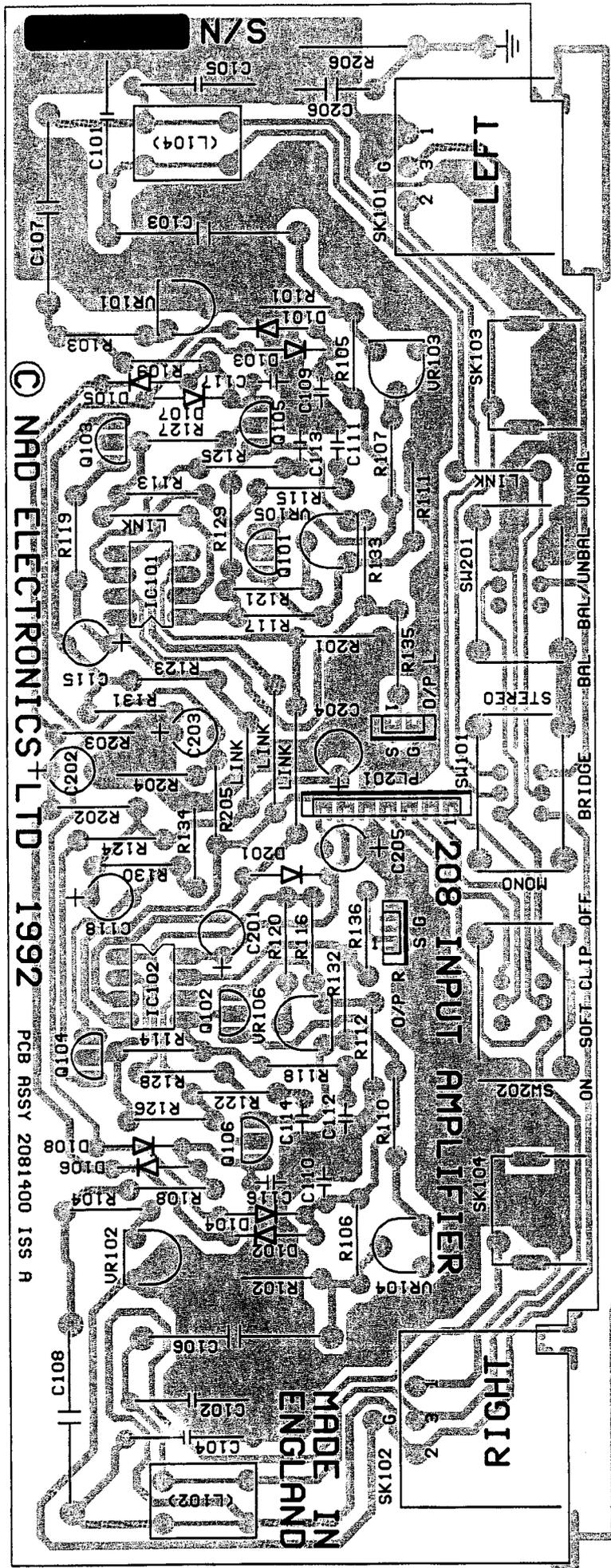
CAUTION:
 FOR CONTINUED PROTECTION
 AGAINST RISK OF FIRE,
 REPLACE ONLY WITH
 SAME TYPE FUSE

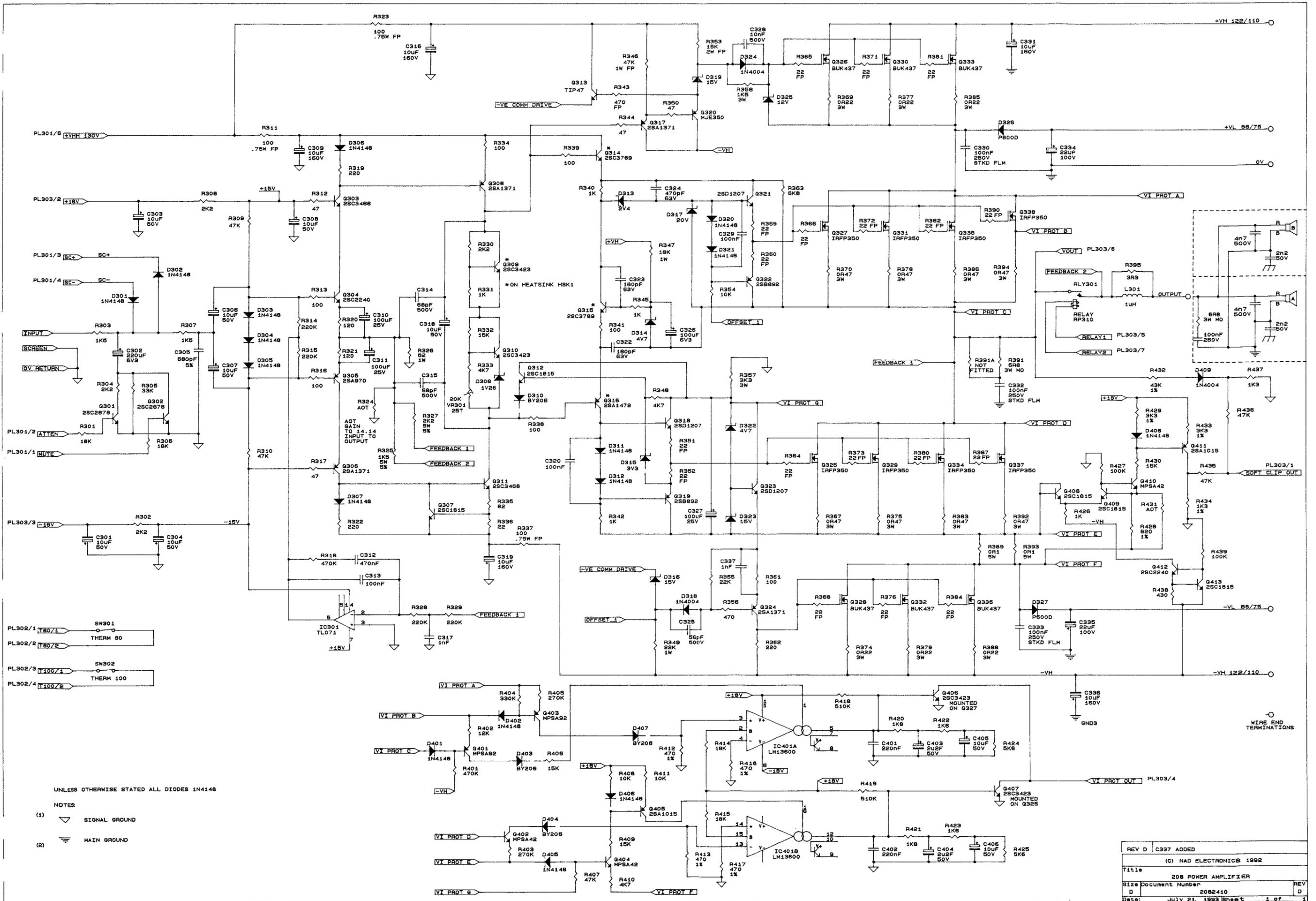
ATTENTION : UTILISER UN FUSIBLE
 DE RECHANGE DE MEME TYPE
 T10R/125V CSA/UL
 T10R/250V SEMKO

X3
 1250mA/125V CSA/UL
 1250mA/250V SEMKO

PC ASSEMBLY
 2083400 VSS B





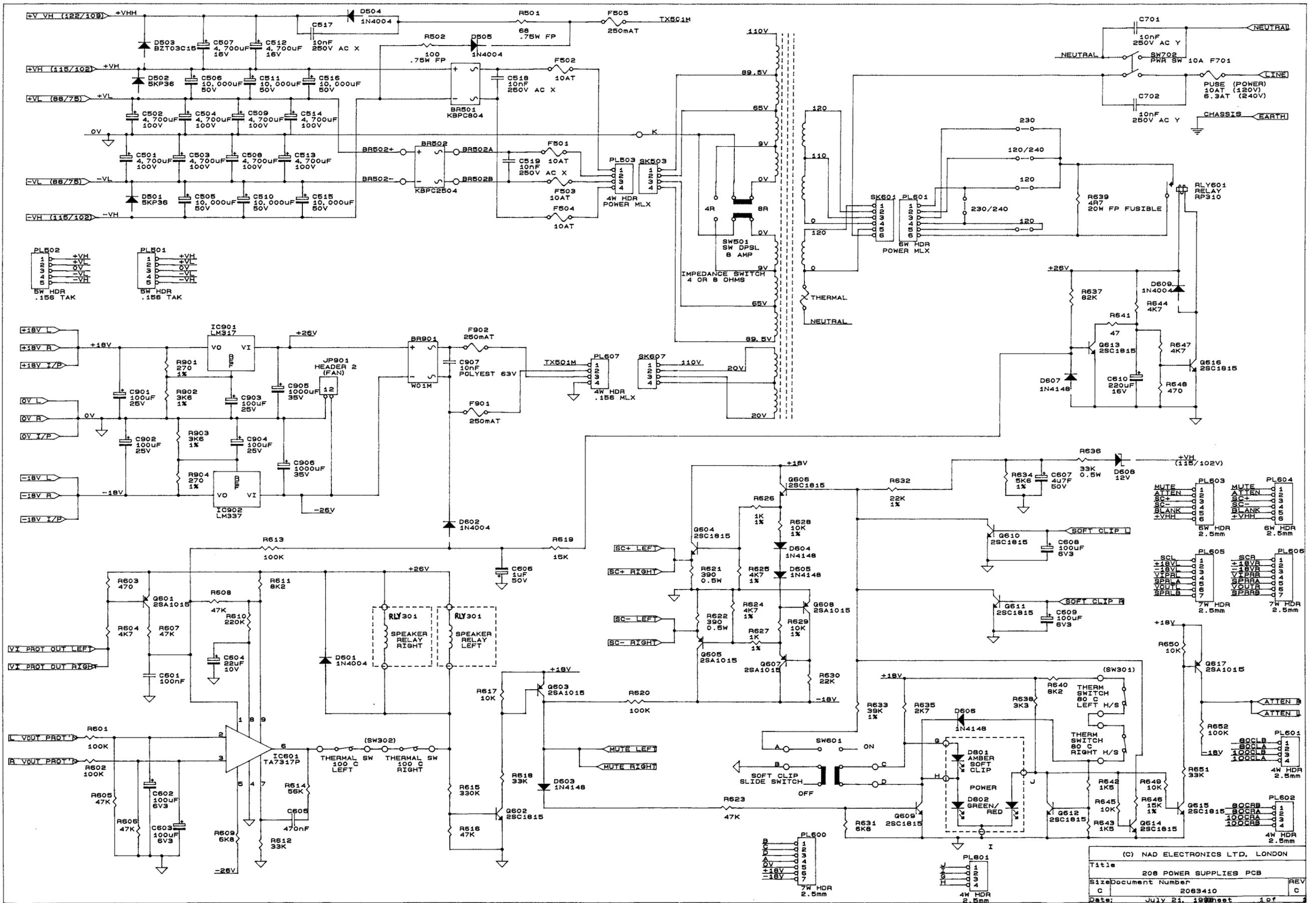


UNLESS OTHERWISE STATED ALL DIODES 1N4148

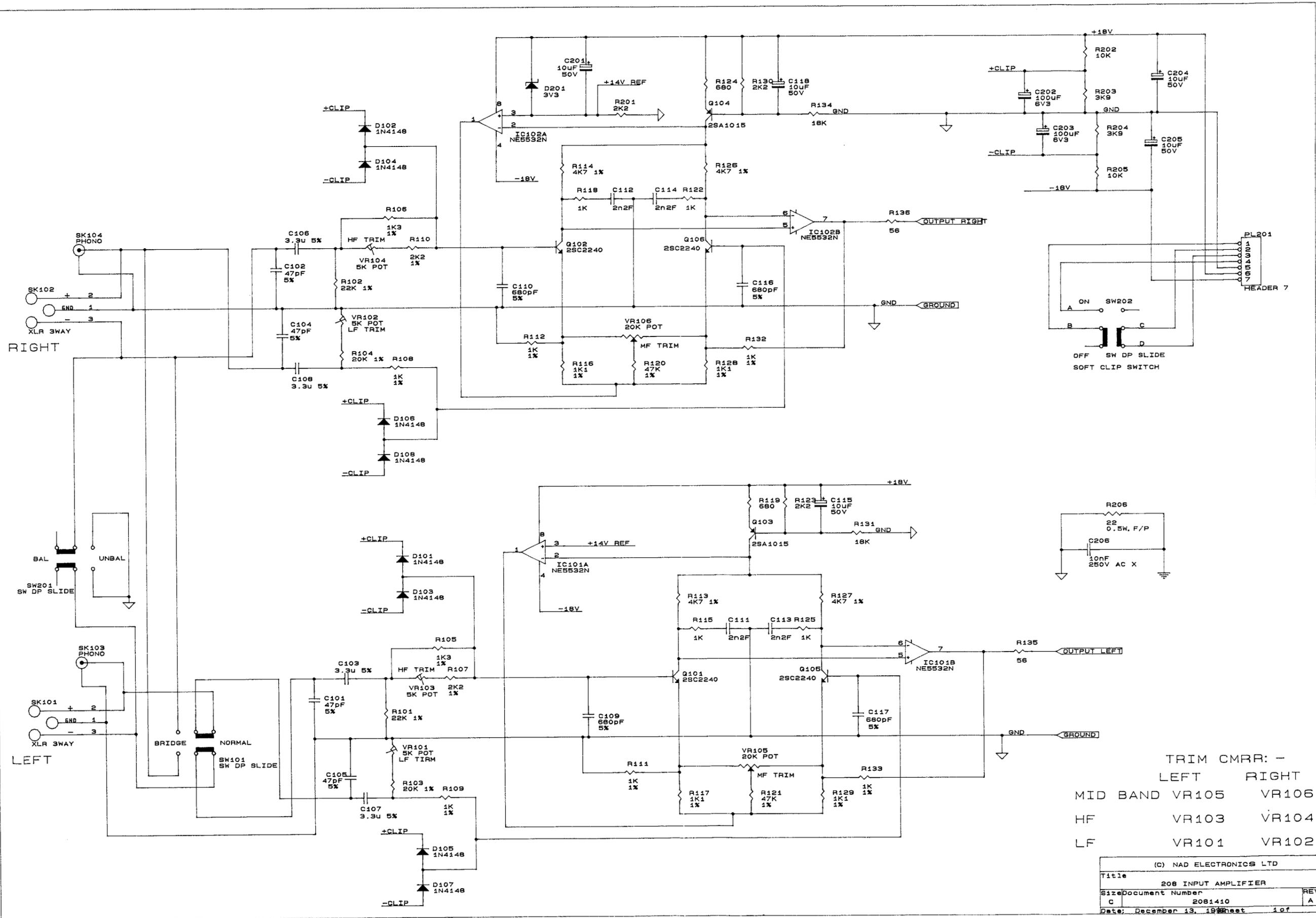
NOTES:

- (1) SIGNAL GROUND
- (2) MAIN GROUND

REV D	C337 ADDED
(C) NAD ELECTRONICS 1992	
Title 200W POWER AMPLIFIER	
Size	Document Number
D	2082410
Date:	July 21, 1992 Sheet 1 of 1



(C) NAD ELECTRONICS LTD, LONDON
 Title 208 POWER SUPPLIES PCB
 Size/Document Number 2083410
 Date: July 21, 1988 sheet 1 of 1



TRIM CMRR: -
 LEFT RIGHT
 MID BAND VR105 VR106
 HF VR103 VR104
 LF VR101 VR102

(C) NAD ELECTRONICS LTD		
Title	20B INPUT AMPLIFIER	
Size/Document Number	C 20B1410	
Date:	December 13, 1988	Sheet 1 of 1

ELECTRONICS PARTS

INPUT AMPLIFIER

Quantity	Reference	Part	Stock No
2	Q104,Q103	2SA1015	OTR0110150
4	Q102,Q101,Q105,Q106	2SC2240	OTR0322400
4	C106,C103,C107,C108	3.3u 5%	OCA4153363
8	D101 - D108	1N4148	ODI0141480
3	SW101,SW201,SW202	SW DP SLIDE	OSW0010001
2	SK102,SK101	XLR 3WAY	OCN0010001
2	SK104,SK103	PHONO	OCN0010002
4	C105,C101,C102,C104	47pF,5%	OCA2304730
2	VR106,VR105	20K POT	ORV0014202
4	VR101,VR102,VR103,VR104	5K POT	ORV0013502
1	D201	3V3 400mW	ODI1100330
2	C202,C203	100uF,6V3	OCA7171006
4	C109,C110,C116,C117	680pF,5%	OCA3116863
2	IC102,IC101	NE5532N	OIC0105532
1	R206	22,0.5W,F/P	ORE1021220
1	C206	10nF,250V	OCA4141079

POWER AMPLIFIER

Quantity	Reference	Part	Stock No
1	Q320	MJE350	OTR0000003
3	Q318,Q321,Q323	2SD1207	OTR0412070
2	Q319,Q322	2SB892	OTR0208920
2	Q314,Q315	2SC3789	OTR0337890
4	Q306,Q308,Q317,Q324	2SA1371	OTR0113710
2	Q304,Q412	2SC2240	OTR0322400
1	Q305	2SA970	OTR0109700
16	D301-307,D311,D312,D320, D321,D401,D402,D405,D406, D408	1N4148	ODI0141480
5	C309,C316,C319,C331,C336	10uF,160V	OCA7161073
3	D324,D318,D409	1N4004	ODI0140040
1	D313	2V4 400mW	ODI1100240
3	D319,D316,D323	15V 400mW	ODI1101150
6	Q326,Q328,Q330,Q332,Q333, Q336	BUK437	OTR0000001
1	R326	62,1W	ORE1041620
1	Q316	2SA1479	OTR0114790
1	R357	3K3,3W	ORE2043330
1	Q313	TIP47	OTR0000004
6	R369,R374,R377,R379,R385, R388	OR22,3W	ORE2020022
2	Q401,Q403	MPSA92	OTR0000006
3	Q404,Q402,Q410	MPSA42	OTR0000005
2	Q405,Q411	2SA1015	OTR0110150

POWER AMPLIFIER (continued)

Quantity	Reference	Part	Stock No
4	D404,D310,D403,D407	BY206	ODI0000002
5	Q408,Q307,Q312,Q409,Q413	2SC1815	OTR0318150
2	Q303,Q311	2SC3468	OTR0334680
1	R325	1K5,5W	ORE2053150
1	R327	2K2,5W	ORE2053220
1	R353	15K,2W FP	ORE1064150
3	C330,C332,C333	100nF,250V	OCA4041081
1	R391	6R8,3W MO	ORE2040680
3	R337,R311,R323	100,.75W FP	ORE1032100
1	R343	470,FP	ORE1012470
18	R365,R351,R352,R359,R360, R364,R366,R368,R371,R372, R373,R376,R380,R381,R382, R384,R387,R390	22,FP	ORE1011220
2	R389,R393	OR1,5W	ORE2030010
8	R375,R367,R370,R378,R383, R386,R392,R394	OR47,3W	ORE2020047
1	SW301	THERM 80	0SE0010080
1	SW302	THERM 100	0SE0010100
2	Q301,Q302	2SC2878	OTR0328780
1	R346	47K,1W FP	ORE1044470
4	Q406,Q309,Q310,Q407	2SC3423	OTR0334230
2	D322,D314	4V7 400mW	ODI1100470
1	D325	12V 400mW	ODI1101120
1	IC301	TL071	OIC0100071
1	R358	1K5,3W	ORE2043150
2	C314,C315	68pF,500V	OCA1106891
1	C305	680pF,5%	OCA3116863
1	IC401	LM13600	OIC0113600
1	D315	3V3 400mW	ODI1100330
1	VR301	20K,25T	ORV0444201
1	D308	1V26 ref	ODI2100126
1	L301	1uH	OWC0010001
1	D317	20V 400mW	ODI1101200
1	RLY301	RELAY SPST	ORY0010310
8	Q337,Q325,Q327,Q329,Q331, Q334,Q335,Q338	IRFP350	OTR0000002
2	D326,D327	P600D	ODI0000001
1	C325	56pF,500V	OCA1105691

POWER SUPPLIES PCB

Quantity	Reference	Part	Stock No
6	C505,C506,C510,C511,C515, C516	10,000uF,50V	OCA7591050
8	C501-504,C508,C509,C513, C514	4,700uF,100V	OCA7584770
3	F505,F901,F902	250mAT	0FU0200250
11	Q602,Q604,Q606, Q609 - Q616	2SC1815	OTR0318150
6	Q601,Q603,Q605,Q607,Q608, Q617	2SA1015	OTR0110150
1	IC601	TA7317P	0IC0107317
4	F501 - F504	10AT	0FU1210000
1	IC901	LM317	0IC0100317
1	IC902	LM337	0IC0100337
2	C905,C906	1000uF,35V	OCA7181035
1	BR501	KBPC804	0BR0010001
1	BR502	KBPC2504	0BR0010002
1	RLY601	RELAY,RP310	0RY0010310
1	BR901	W01M	0BR0010003
5	D504,D505,D601,D602,D609	1N4004	0DI0140040
2	C507,C512	4,700uF,16V	OCA7184716
1	D503	BZT03C15	0DI0000004
2	D501,D502	5KP36	0DI0000003
1	SW501	SW DPSL,8 AMP	0SW0010002
1	R501	68,.75W FP	0RE1031680
5	D603 - D607	1N4148	0DI0141480
1	D801	LED, AMBER	0OP0010002
1	D802	LED, RED/GREEN	0OP0010001
1	R639	4R7,20W FP	0RE9000470
1	D608	12V 400mW	0DI1101120
1	R502	100, .75W, FP	0RE1032100

LOUDSPEAKERS PCBs

Quantity	Reference	Part	Stock No
2		6R8 3W 5% MO	0RE2040680
4		4n7F 500V	OCA1124791
2		100nF 250V	OCA4041081

CHASSIS PARTS

Stock No	Part	Quantity
0MK20800015	FASCIA N208-03 FINISH	1
0MK20800046	COVER PLATE N208-C4 FINISH	1
0MK20800077	SUBFASCIA N208-C7	1
0PM20800022	BADGE N208-C9 FINISH	1
0CN0010003	SPEAKER TERMINAL,4X4MM	2
0PM20800045	ISOLATION BOX NUL-01 FINISH	2
0FU1210000	FUSE,10AT CERAMIC	2
0MA0010001	PLASTIC FEET,RICHCO	4
0SW0010002	8A SLIDE SW DPDT (IMPEDANCE SW)	1
0SW0020001	POWER SWITCH DPST 10A	1
0PM20800016	ESCUTCHEON N208-C8	1
0PM20800031	POWER BUTTON N208-C10	1
0HK00100027	HEATSINK L REAR N208-04 FIN	1
0HK00100038	HEATSINK L FRONT N208-04 FIN	1
0HK00100047	HEATSINK R REAR N208-04 FIN	1
0HK00100058	HEATSINK R FRONT N208-04 FIN	1
APA2082301A	POWER AMPLIFIER ASSEMBLY, LEFT	1
APA2082302A	POWER AMP PCB ASSEMBLY, RIGHT	1
APA2084400A	LED ASSEMBLY	1
ATX2080001A	208 MAINS TRANSFORMER ASSEMBLY	1

FASTENERS

Ref	Stock No.	Part
1	0FA5140038	SCREW SELF-TAP No.4B 3/8 FL BK
2	0FA5060025	SCREW SELF-TAP No.6B 1/4 PAN POZI ZN CLR
3	0FA3103006	SCREW TAPTITE M3*6 PAN POZ BK
4	0FA3103008	SCREW TAPTITE M3*8 PAN POZ BK
5	0FA3103012	SCREW TAPTITE M3*12 PAN POZ BK
6	0FA3003010	SCREW TAPTITE M3*10 PAN POZ CP
7	0FA3003012	SCREW TAPTITE M3*12 PAN POZ CP
8	0FA3104010	SCREW TAPTITE M4*10 PAN POZ BK
9	0FA3104016	SCREW TAPTITE M4*16 PAN POZ BK
10	0FA0003006	SCREW M/C M3*6 PAN POZ CP
11	0FA0003010	SCREW M/C M3*10 PAN POZ CP
12	0FA0103010	SCREW M/C M3*10 PAN POZ BK
13	0FA0304010	SCREW M/C M4*10 SOCKET-CAPS BK
14	0FA0505016	SCREW M/C M5*16 SOCKET-BUTT BK
15	0FA7003000	NUT M3 STEEL FULL ZN CLR
16	0FA8103000	WASHER M3 SPRING
17	0FA8203000	WASHER M3 EXT. TOOTH ZN CLR
18	0FA9000004	NYLON WASHER 7.3MM BK
19	0FA9000003	NYLON WASHER 9.5MM BK
20	0FA9000002	5/16 X 1 1/4 WASHER ZN/CLR
21	0FA6008000	BOLT M8 X 90, TRANSFORMER
22	0FA7408000	NUT M8 NYLOX, TRANSFORMER
23	0FA8008000	WASHER M8 PLAIN, TRANSFORMER

Fastener locations

Top cover - chassis	9 x #1	9 x #18		
Fascia - chassis	4 x #14	4 x #19		
Phono sockets - rear	2 x #1			
XLR - rear	4 x #12			
Power amps to heatsink	12 x #5			
Escutcheon - subfascia	1 x #2			
	(CAUTION: do not use a longer screw)			
Power switch- subfascia	2 x #10			
Impedance switch - rear	2 x #12	2 x #15	2 x #16	2 x #17
Subfascia-heatsinks	4 x #8			
Rear panel - heatsinks	4 x #8			
Bridge - LH heatsink	1 x #9			
PSU PCB - base	6 x #11	6 x #16		
Transformer - subfascia	1 x #20	1 x #21	1 x #22	1 x #23
Isolation box - rear	4 x #4			
T-bar fixings:				
Transistor clamps	14 x #13			
Transistor tabs	2 x #4	4 x #6	6 x #16	
Thermal switches	2 x #7	2 x #16		
Sense trans (Q406/407)	2 x #7	2 x #16		
Power amp PCB	6 x #3			