MISSION OWNER'S MANUAL

MISSION 776/777 UNPACKING-INSTALLATION

MODEL 776

The following items are included with the pre-amplifier.

- Warranty card
- Owners manual
- Pre-amplifier line cord
- Banana plug
- 1 spare line fuse

MODEL 777

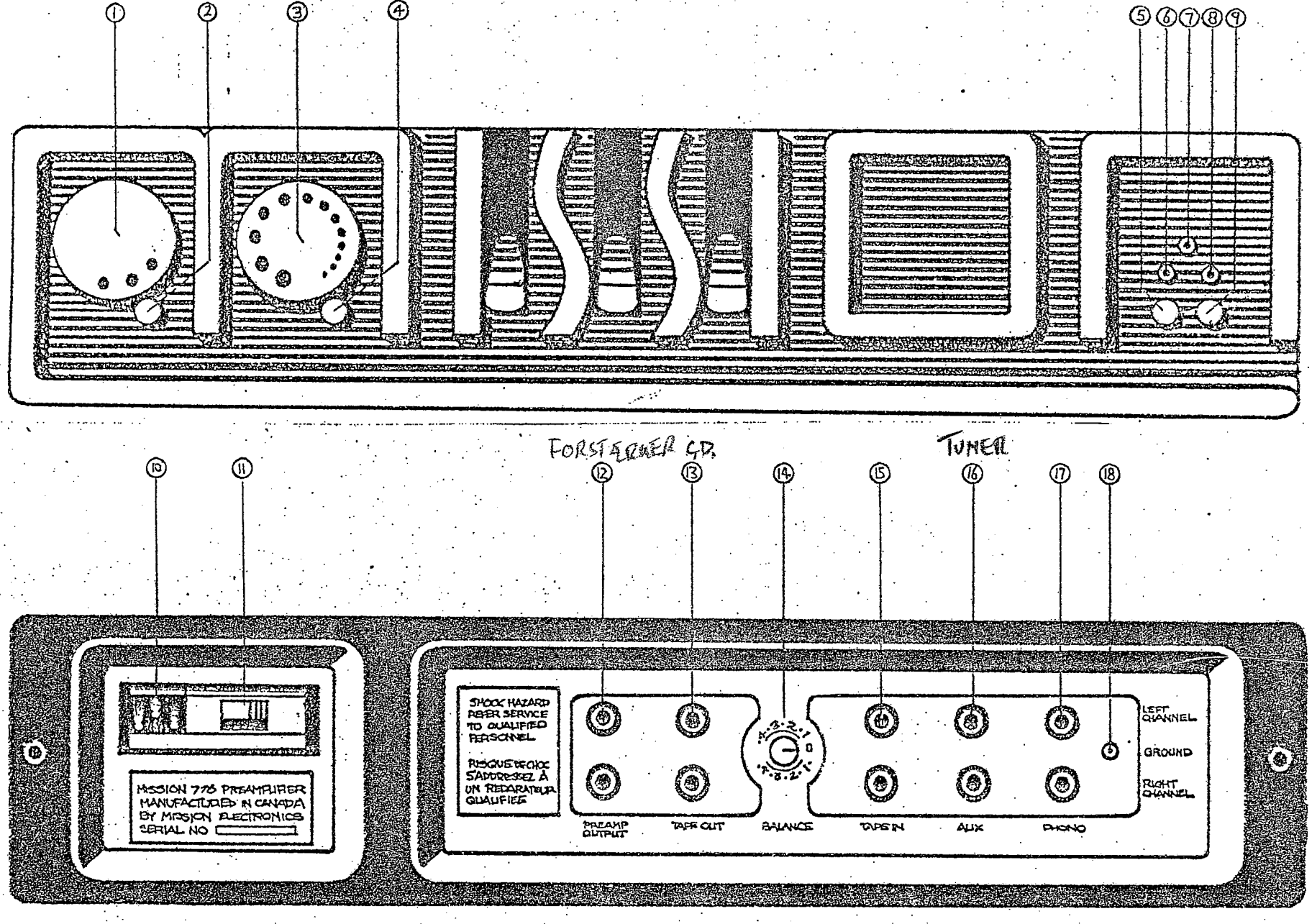
The following items are included with the power amplifier.

- Warranty card
- Owners manual
- Power amplifier line cord
- 1 spare line fuse, 2 spare output fuses

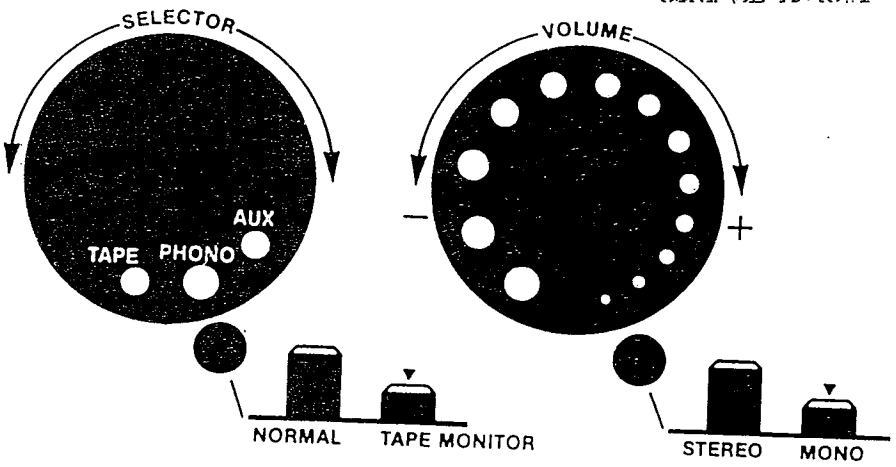
If any of the above items are not included contact your dealer or the factory.

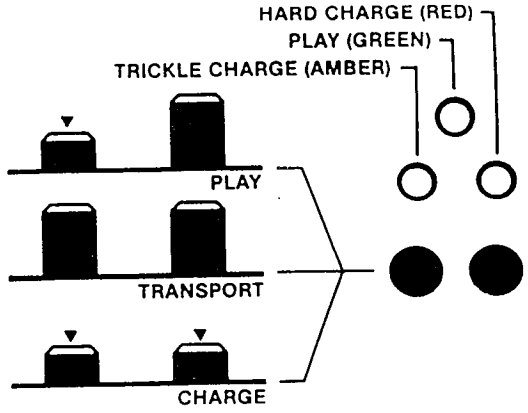
IMPORTANT:

REFER TO OPERATING INSTRUCTIONS PRIOR TO USING SYSTEM.



PRE-AMPLIFIER 776


SELECTOR
AUX
TAPE
PHONO
NORMAL
TAPE MONITOR
VOLUME
–
+
STEREO
MONO


HARD CHARGE (RED)
PLAY (GREEN)
TRICKLE CHARGE (AMBER)
PLAY
TRANSPORT
CHARGE

MISSION 776 OPERATING INSTRUCTIONS

(Bracketed numbers refer to panel drawings)

FRONT PANEL

1. ON/OFF SWITCH (5) & (9)

There are two push button switches situated on the right hand side of the front panel, the switch on the extreme right is designated "S1" (9) and beside it is "S2" (5).

With switch "S1" in the "out" position and "S2" depressed the preamplifier is powered from the internal battery and all A.C. line currents are disconnected. After about 20 seconds the green L.E.D. (7) will light up indicating the normal operating mode of the amplifier.

When both switches are in the "out" position the amplifier is totally dead and is in its transportation mode.

With switch "S1" depressed (S2 in either position) the pre-amplifier is shut down and the battery is put on charge. When this is done the red L.E.D. (8) must always come on to indicate full charging mode. If the battery requires full charging the red L.E.D. will remain on; otherwise, after a few minutes the yellow L.E.D. (6) will illuminate indicating trickle charge mode.

The switch over from full charge to trickle charge is done automatically.

In order to avoid the situation of having a discharged battery just when you wanted to use the amplifier, it is recommended that after normal use the preamplifier be switched to charge mode. The battery can be left on charge for several days and weeks ready to be used. A fully charged battery can produce optimum performance for as long as 20-30 hours of continuous use.

2. INPUT SELECTOR SWITCH (1)

The input selector switch is located at the extreme left of the front panel. The input selected is indicated by the lining up of the indentations on the selector switch knob with the push button (2) just under it. The middle indentation represents phono, left indentation is tape and the right indentation is auxiliary input.

3. VOLUME CONTROL (3)

The volume control is the knob with progressively enlarged indentations which indicate volume setting. Its alignment is relative to the push button (4) just under it. The volume control adjusts gain from -70db (small indentation) up to 0db or full gain (large indentation) in a stepwise fashion.

4. TAPE MONITOR SWITCH (2)

This is the push button under the input selector knob (1). Tape monitor is selected by depressing the button.

5. MONO/STEREO SWITCH (4)

This push button is located under the volume knob (3). Mono operation is selected by depressing the button.

BACK PANEL

NOTE: the top row of audio connectors represents the LEFT channel and the bottom row the RIGHT channel.

1. A.C. CONNECTOR HOUSING (10) & (11)

The detachable line cord connects to the 776 at A.C. input (10). Access to the line fuse (11) is possible only when the line cord has been disconnected and the clear plastic window is moved aside. The fuse housing (11) also contains a small universal voltage card that selects the correct line voltage for the country in which the amplifier is used.

See precautionary measures for correct line voltage and fuse rating.

2. GROUND (18)

Most high quality turntables are manufactured with a separate grounding wire. This wire does not carry signal current but is provided for shielding purposes.

It is very important that the tonearm metal work and the platter be at the same potential as the preamplifier chassis. If a separate grounding wire is not provided then the shield connection is automatically done through the turntable interconnects - although this method is not as effective as the separate wire approach.

Included with the preamplifier is a solderless banana plug for connecting a separate ground wire. Strip 3/4 inch of insulation from the wire and unscrew plastic cap from banana plug. Push the wire through the small hole of the plastic cap and into the centre hole of the metal plug so that the stripped portion of wire extends out the side hole. Wrap the bare portion of wire around and under the exposed metal collar of the plug.

Tighten securely the plastic cap to the banana plug. For a proper connection no bare wire will be visible.

3. PHONO INPUT (17)

The phono input will accept signal from any moving magnet or high output moving coil cartridge.

4. AUXILARY INPUT (16)

This input will accept any line level connection. Most often this will be the output of a tuner, but it could also be the output of a second tape recorder. This would then allow tape copying if another recorder was connected via tape input.

5. TAPE INPUT (5)

This input will accept any line level connection. Most often this will be the output of a tape recorder, but it could also be the output of a television with stereo capability.

6. BALANCE (14) IMPORTANT NOTICE

In spite of the special care taken in implementation of the balance control feature (use of the highest quality switches and incorporating the circuitry in the feedback loop, in order to further reduce any adverse effects of this feature), our recent findings show that this control is somewhat detrimental to the high quality sonic reproduction of the 776.

Given our commitment to straight line philosophy and the type of associated equipment which would invariably be used with this genre of equipment the usefulness of a balance control, at all, is questionable.

Considering the pros and cons, Mission have decided to elminate the balance control feature in the new generation of the 776 preamplifiers.

Depending on the production batch which you will receive, you will find that the balance control switch (back panel) may or may not be installed. On models where the switch has already been installed the balance control circuit has been disabled.

7. TAPE OUTPUT (13)

Interconnect cables run from here to the line input of a tape recorder to permit recording from any source as selected by the input selector switch. That is, phono, tuner, television, or another tape recorder.

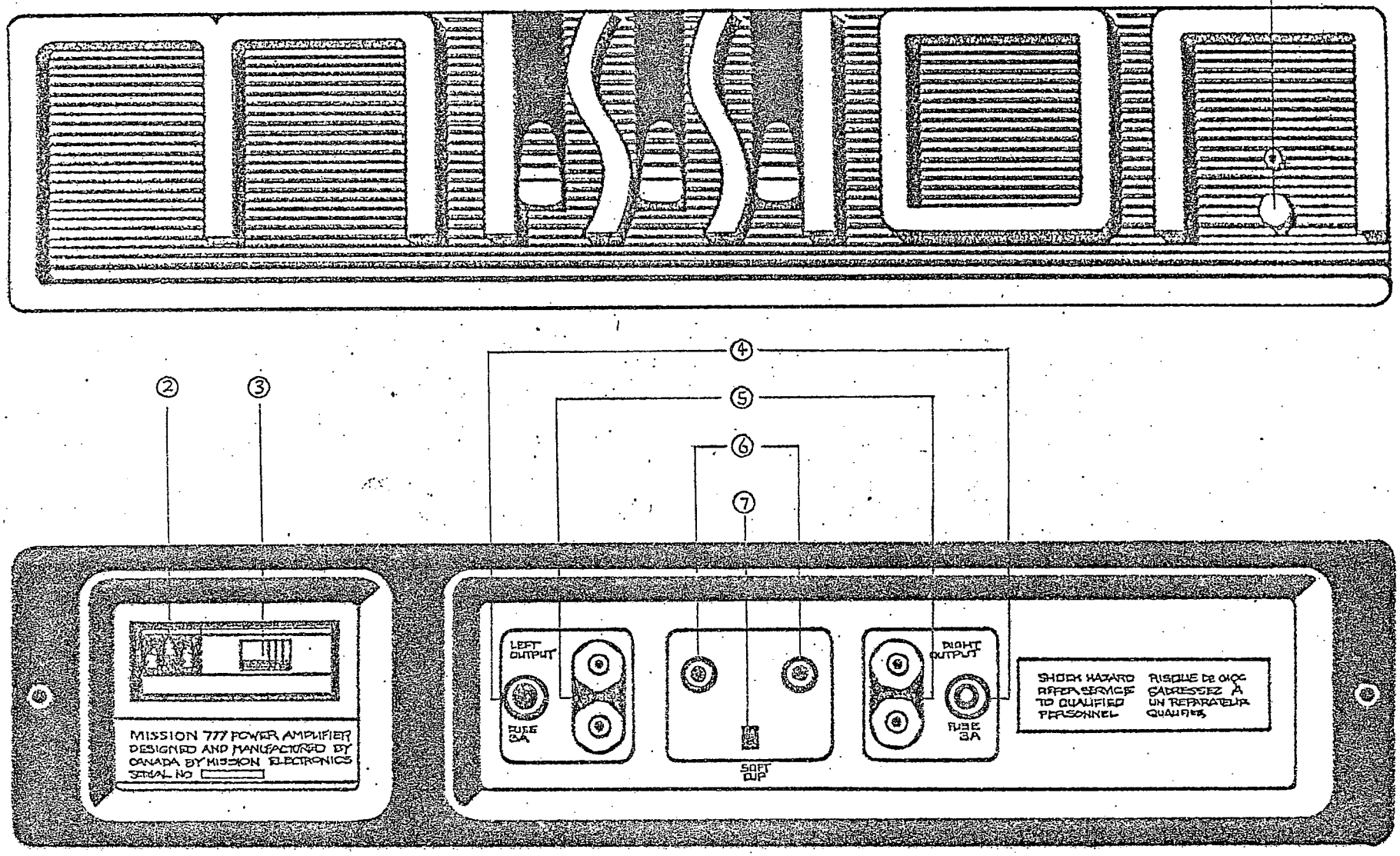
8. PREAMPLIFIER OUTPUT (12)

Interconnect cables run from here to the main input of the power amplifier. This output can also feed an equalizer which in turn would feed the input of the power amplifier.

SPECIFICATIONS

MISSION 776 PREAMPLIFIER

Input Sensitivity:	Phono: 2 m.v. for 1 volt rms output Line: 100 m.v. for 1 volt rms output	
Input Overload at 1 KHz:	Phono stage	150 m.v.
Output Level:	Nominal Maximum	1 volt rms 11 volts peak
Input Impedance:	47 K ohms, 150 p.F.	
Output Impedance:	250 ohms, 4.7 u.F.	
Signal/Noise:	Phono input	80dB "A" weighted 20Hz - 20KHz (reference 5 m.v. input)
	Line input	95dB "CCIR" weighted 20Hz - 20KHz (reference 200 m.v. input)
	HUM	greater than 100dB below rated output
Volume Control:	Channels track within 0.2 dB from 0 dB down to - 70dB	
Distortion:	THD: less than 0.5% (20Hz-20KHz) IMD: less than 0.5% (60Hz and 7KHz at 4:1) TID: immeasurable	
Frequency Response:	Phono: ± 0.2 dB - 3 dB Line: - 0.2 dB	20Hz-20KHz 10Hz-50KHz 20Hz and 20KHz



POWER AMPLIFIER 777

MISSION 777 OPERATING INSTRUCTIONS

(Bracketed numbers refer to panel drawings)

FRONT PANEL

1. GREEN L.E.D. (1)

   This light illuminates when the amplifier is turned on.

2. ON/OFF SWITCH (1)

   Self explanatory.

BACK PANEL

1. A.C. CONNECTOR HOUSING (2) & (3)

   The detachable line cord connects to the 777 at A.C. input (2). Access to the line fuse (3) is possible only when the line cord has been disconnected and the clear plastic window is moved aside. The fuse housing (3) also contains a small universal voltage card that selects the correct line voltage for the country in which the amplifier is used.

   See precautionary measures for correct line voltage and fuse rating.

2. INPUT (6)

   Interconnect cables from the preamplifier output connect here.

3. OUTPUT (5)

   These five way heavy duty binding posts provide different methods of connecting the speaker cable to the amplifier. For example, when using multi-strand heavy guage wire, divide the conductors into two parts, pass one half through the hole in the terminal and wrap the remainder around the terminal post. Tighten plastic cap to secure wire. These terminals are also equipped to accept standard banana plugs.

4. OUTPUT FUSE (4)

Individual 3.5 ampere fast blow fuses are installed at the factory. These fuses protect the loudspeakers from overload conditions and the amplifier from shorted speaker wires.

See precautionary measures for correct fuse rating.

5. SOFT CLIP (7) IMPORTANT NOTICE

Due to inherently excellent clipping characteristics and ample headroom of the 777 power amplifier, reports from the field and recommendations made by many reviewers indicate that the soft clip feature incorporated in the amplifier is redundant.

In order to simplify and at the same time eliminate any degradation of the sonic quality which may arise from intentional or inadvertant usage of this feature, the soft clip switch has been completely disabled.

SPECIFICATIONS

MISSION 777 POWER AMPLIFIER

Input Sensitivity:	775 m.v. for 28.4v rms out (100w into 8 ohms)
Power:	Greater than 100watts/ch. (8 ohms) Greater than 175watts/ch. (4 ohms) (continuous power output with both channels driven from 20Hz - 20KHz)
Slew Rate:	150 volts/microsecond
Rise Time:	0.32 microsecond
Damping Factor:	60 (DC - 40KHz)
Open Loop Bandwidth:	230KHz
Closed Loop Bandwidth:	1.15MHz
Negative Feedback:	14 dB
Current Delivery:	10 amps RMS continuous 40 amps peak-to-peak instantaneous
THD:	Less than 0.2% (DC-40KHz)
Difference Frequency Distortion:	0.05% (10 watts into 8 ohms, 300Hz apart, swept from 0 - 200KHz)
IMD:	0.05% (10 watts into 8 ohms, 70Hz, fixed and swept from 0 - 200KHz, 4:1 ratio)
Signal/Noise:	Better than 100 dB

PRECAUTIONARY MEASURES

1. When disconnecting any piece of equipment such as a tape deck, tuner, etc. be sure to turn off system power.

2. When changing records, re-dialing tuner or rewinding tapes, it is recommended that the volume control be turned down.

3. The 777 amplifier can be positioned wherever convenient, provided that some unrestricted airflow is permitted at the top and bottom of the case. Do not place the amplifier on carpeting or any other material that would restrict airflow. Under normal conditions the 777 will get moderately warm.

4. If it is necessary to replace a fuse, be sure to maintain the proper fuse rating.

   (A) LINE FUSE (refer to back panel drawings (3) & (11).

   JAPAN (100 volt): 3/4 ampere, slow blow, Model 776
   5 ampere, slow blow, Model 777

   NORTH AMERICA (120 volt): 1/2 ampere, slow blow, Model 776
   4 ampere, slow blow, Model 777

   U.K. & EUROPE (220-240 volt): 1/4 ampere, slow blow, Model 776
   2 ampere, slow blow, Model 777

   When selecting a different line voltage, remove and rotate voltage card to desired voltage, then reinsert card such that the printed voltage is clearly visible through the window. Change the fuse according to the above specifications.

PRECAUTIONARY MEASURES CON'T.

4. (B) OUTPUT (PROTECTION) FUSE, MODEL 777
(refer to back panel drawing (4).)

USING 8 OHM SPEAKERS: 3½ or 4 ampere, fast blow

USING 4 OHM SPEAKERS: 5 ampere, fast blow

5. For best possible signal to noise figures Model 776 and 777 amplifiers must be connected to a properly grounded outlet. Do not remove the third wire grounding pin on power cord plug.

6. Do not use high gauge high capacitance audio cable.

SPEAKER CABLE should be 14 gauge for runs of under 20 feet, otherwise use 12 gauge or lower. In either case the cable must be multi strand of pure copper. It is recommended that positive and negative wires to the same speaker be separated a couple of inches for best results.

INTERCONNECT CABLE should be low capacitance with a braided shield.

IN CASE OF TROUBLE

SYMPTOM	PROBABLE CAUSE & CURE
No sound from one or both speakers.	A) Check for blown or missing fuses in speakers and at (3) of model 777. B) Insure that all cable connections are correct and secure to (2), (5), (6), of 777 and (12), (13), (15), (16), (17) of 776. C) Insure that 776 batteries are fully charged. Refer to operating instructions.
Low volume sound from one or both speakers.	Check for blown fuses at (4) of model 777. These protection fuses are wired in the feedback loop - if the fuse blows some sound will be audible.

TROUBLE CON'T.

SYMPTOM	PROBABLE CAUSE & CURE
Hum or crackling from one or both speakers. This problem is usually caused by a faulty ground connection of a shielded interconnecting cable.	A) Insure that there are no faulty interconnect cables. B) Insure that all interconnect cable plugs are secure (PUSHED IN) to (12), (13), (15), (16), (17), of 776 and (6) of 777. C) Attach all available chassis grounding wires from turntable, tuner, tape deck, etc. to (18) of 776. Use banana plug supplied.
Radio frequency pick-up audible from one or both speakers. The Mission 776/777 amplifiers have been designed to reject most R.F. interference. However, R.F.I. can be a problem depending on where you live and the quality of associated equipment used with the 776 or 777 amplifiers.	D) Long cable runs including speaker wire can act as antennas causing R.F.I. problems. If the above remedies do not work then ferrite rings must be installed on the offending cable. These rings will remove the R.F.I. without affecting sound reproduction. Contact your audio dealer or the factory for further information.

TROUBLE CON'T.

SYMPTOM	PROBABLE CAUSE & CURE
Music reproduction sounds hollow, certain instruments lack definition.	Speaker POSITIVE & NEGATIVE terminals are reversed causing frequency cancellation. Insure that the speakers are connected properly: red (+) terminal of 777 LEFT channel goes to red (+) terminal of LEFT speaker and black (-) terminal of 777 LEFT channel goes to black (-) terminal of LEFT speaker. Repeat for the RIGHT channel.

Mission 776 Preamplifier

Mission 777 Power Amplifier

Congratulations on your excellent choice! Your Mission preamplifier and/or power amplifier are precision manufactured products and have been tested to the highest standards. A few minutes spent in reading your instruction manual will ensure that you get optimum results from your system and your investment will prove long term.

IMPORTANT NOTES

1. Before switching the equipment on, please ensure that it is correct for your local power supply. The preamplifier and power amplifier are made in different versions for different parts of the world. Please refer to the detailed instructions for each unit for more information.
2. Mission equipment is manufactured to the highest quality standards. All Mission preamplifiers and amplifiers are warranted to be free of defects in materials and workmanship for a period of three years from date of purchase.
3. Please retain packing materials. You may need them again for safe transport of the equipment.

INTRODUCTION

Traditionally, amplifiers are designed as mathematical models their characteristics measured under steady-state conditions, and their quality judged by a simple set of specifications. This is inadequate for an amplifier dynamically operating to reproduce music. It is the dynamic behaviour of an audio amplifier with complex interface (input/output) transducers when driving reactive loads that highlights many obscure problems. Many "theoretically-perfect" designs suffer serious clipping distortions during musical transients; are unable to drive complex speaker loads; create poor interface with cartridge transducers; have inadequate power-supplies; use IC's in place of discrete components; and ignore the detrimental

effect of excessive switches and gadgets.

As for specifications, historically too much emphasis was placed on parameters such as THD or bandwidth. This resulted in excessive use of overall feedback - enhancing specifications by reducing the amplitude of low-order harmonics but generating high-order harmonics and listening fatigue. Again much was made of bandwidth and speed of amplifiers. Figures of 1MHZ were considered desirable. But such figures do not reveal the critical ratio of power supply bandwidth to audio bandwidth; the amount of feedback used to achieve such specifications; linearity with varying power levels; and the respective relationship between the closed and open-loop curves. Also, steadystate measurements ignore time domain problems such as time and phase errors resulting in incoherent musical information.

The Mission designs are the result of a new look at the fundamental parameters and basic operating functions of an audio amplifier. Our research has been painstaking in careful evaluation and correlation of sujective results with advanced and novel measurements.

Considerable effort was made to create inherently stable circuit designs capable of driving all complex loads and eliminating conventional protection circuits, Zobel networks coupling capacitors, etc. The 777 achieves the unprecedented open-loop bandwidth of 230KHZ resulting in 1.15MHZ bandwidth with a mere 14db overall feedback!

Discrete components are used throughout, switches and connectors kept to a bare minimum. Exceptionally low output impedance power supply is utilized with some 70,000 filtering capacity.

A totally linear harmonic distortion pattern is achieved with rapidly diminishing high order harmonics. Complex distortions measured over a large frequency band are negligible. The slewing rate of the 777 is a staggering 180 volts per micro second, thereby eliminating all dynamically induced distortions such as TIM, with special attention given to slewing behaviour at maximum output swings. The 777 is DC coupled

throughout, designed as a perfectly symmetrical class "A" amplifier, except for the high technology H-FET output devices which operate in class "AB" mode. The sonic superiority of this product is immediately audible in its clean and exciting dynamic range permitting amplification of musical transients without clipping! To rate the 777 as a 200W amplifier, therfore, does not do justice to its transient capabilities - more suitably rated in kilowatts.

The revolutionary battery powered 776 straight line preamplifier is strictly for the purist, paying particular attention to the all important role of power supply rejections. A true RIAA equalisation curve is followed to within 0.2db accuracy (as against arbitrary roll-offs) to ensure phase accuracy at low frequencies. The phono stage overall feedback is kept to less than 10db at 30HZ to minimize dynamically induced distortions while maintaining the noise level at below -80db! Special attention has been given to the quality of the components, the effect of switches and connectors, etc. and their behavioural changes with temperature and aging. Therefore, near military grade components have been used throughout, and both amplifiers are manufactured in an extravagant sculptured solid aluminum casing.

DESIGN PHILOSOPHY

A. General:

Mission strongly believes in straight line amplifier design, eliminating all unnecessary, fancy and harmful features offered by most designs on the market.

The tone control in preamplifiers, for instance, is believed to be absolutely unnecessary, in as much as no simple tone control configuration can equalize a room acoustically, nor will it compensate for bad recordings. At the same time, tone controls add false spices to the program material which are totally undesirable. We suggest that better results can be achieved by careful positioning of the loudspeakers in the room, or in extreme cases the use of very high

quality equalizers in the chain.

We have observed the problems and distortions associated with switch contacts and connectors, and strongly believe that if and when necessary, only the highest quality, gold plated contact switches and connectors should be used in the signal path. It is quite unfortunate, however, that in practical designs many such devices must be used; the secret therefore, is to keep them to a minimum number of only the highest quality.

The use of protection circuitry in power amplifiers, as an example, very often detracts from straight line philosophy and one way or another causes aberrations in the behaviour of the amplifier in delivering high currents to the load.

B. Power Supply:

The power supply, perhaps, plays as important a role as the actual circuitry of the amplifier in the reproduction of the audio signal. Some prominent people in the industry have addressed the subject and we have shown in our research work that the power supply is an integral part of the reproduction chain.

It is important to conceive of the power supply not as a peripheral component, merely necessary to provide DC voltage for the amplifier, but as a charge storage device controlled by the amplifier to deliver current as required for replicating the signal input, across the load, readily and without any hinderance. To achieve this requires a power supply with extremely low output impedance and a bandwidth in excess of that of the amplifier.

C. Amplifier:

The amplifier section is, of course, most responsible for quality of music reproduction. Parameters normally measured and referred to for the evaluation and comparison of amplifiers generally tell the truth, but not the whole truth. Total harmonic distortion, for instance has been given a lot of false weight for too long, whereas until recent years not much attention was given to dynamically

induced distortions, stability and realistic load handling capabilities of the power amplifier.

We believe that the complete and true yardstick for measurement and evaluation has not yet been discovered. However, there are certain parameters which best relate subjective evaluation to the objective measurements. These are briefly as follows;

1. Measure of stability of the amplifier to be tolerant to all types of realistic but awkward reactive loads.
2. Utilization of a minimum amount of overall feedback - just enough to keep distortions down to acceptable levels (which means that the open loop distortions in the amplifier should be inherently low.)
3. Bandwidth; it is important that this be large enough in its open loop value. We believe that the open loop bandwidth should be several times larger than the signal bandwidth at the input of the amplifier in order to prevent any type of dynamically induced distortions due to band limiting of the amplifier stages.
4. Linearity of distortion, that is;
   a. constancy of percentage distortion with increase of power (mainly in the power amplifier).
   b. comb type distortion characteristics with rapidly diminishing high order harmonics.
5. Slewing rate, but more important is slewing behaviour at maximum output swings.
6. Complex distortion measurements over a wide frequency band (that is, swept intermodulation and different frequency distortions), paying special attention to high order distortion components in the former, and low frequency distortion components of the latter.

7. Clipping behaviour of the amplifier; that is, whether or not the undesirable garbage on the DC voltage rails is passed on to the load at clipping, and speed of recovery from clipped output.

8. Inherently low output impedance (open loop), together with low overall feedback in order to minimize interface distortions caused by the speaker's back emf appearing at the output of the power amplifier and thus regenerating through the feedback loop.

9. Distortions under dynamic conditions which are largely a function of the above parameters in general.

776 PREAMPLIFIER

1. Construction:

a. Mechanical

The amplifier case is the same casting as used in the 777 power amplifier; the logo in the front panel acting, in this case, as a recess for knobs and switches.

The inside of the amplifier is completely exposed when the top plate is removed which facilitates servicing of the unit.

Generally, it should not be necessary to remove the chassis in order to replace any major components.

b. General

The 776 has been designed to be modular in construction, while keeping the number of connectors and contacts in the signal path to an absolute minimum. Switches and connectors used are of the best quality with gold plated contacts.

The layout of the modules and components has been done in such a way as to minimize interconnecting tracks and signal path lengths, while most tracks on the printed circuit board are doubled up on both sides in order to reduce interconnecting resistance in the signal path. All printed circuit boards have 2 ozs of copper tracks on each side.

c. Components

1. All active components used in the amplifier section of the 776 are of the low noise discrete type, with high gain x bandwidth figures. This is because no

integrated circuit (operational amplifier) has yet been made available with a wide enough open loop bandwidth for true high fidelity reproduction.

2. Use of coupling capacitors, however, has been unavoidable in the 776. When this has been necessary, the best polyester capacitors have been mixed and doubled up (from 5 top quality manufacturers) in order to reduce the sonic signature of one type or make. We have shown in our research work that each make of capacitors has its own structural signature which can be added to the program material as coloration.

3. Throughout the preamplifier only the best quality 1% metal film resistors have been used to ensure accuracy of gain and channel balance throughout the audio band. These are, in most cases, over-rated in order to reduce thermal noise.

4. An instrument type line connector, incorporating line fuse and line voltage selector card is used for safety and ease of transportation/handling.

2. Power Supply

The power supply for the 776 preamplifier modules is derived from two beefy batteries (rechargeable and sealed) providing 25 volts DC at 1.5 amperes/hour capacity. These are followed by two stages of filtering through 10,000 microfarads and then separating two channels by the second stage of filtering through 2200 microfarad capacitors decoupled by 4.7 microfarad polyester capacitors.

This configuration ensures: (i) zero line induced hum. (ii) very low impedance as seen by the amplifier throughout the audio spectrum. (iii) an excellent inter-channel power supply rejection.

When the amplifier is in its play mode, all line AC coming into the amplifier case is cut off, ensuring no line hum

pick up within the preamplifier unit.

When the amplifier is not inuse and the battery is put on full charge; the circuit will change over to trickle charge mode automatically when the battery is within 97% of its final charge. The amplifier can remain in this mode of charge indefinitely. The battery can produce optimum performance for as long as 20-30 hours of continuous use. It is recommended, however, that the battery be put on charge after each long listening session.

3. Preamplifier

Two identical modules make up the two channels of the pre-amplifier, each consisting of a phono and a line section.

a. Phono Stage

This stage uses a low noise differential amplifier followed by a current pumping voltage amplifier stage. The active RIAA equalization network in the feedback loop utilizes precision components in order to ensure ± 0.2 dB accuracy of the frequency response. A true RIAA equalization curve has been followed (as against RIAA/IEC standards or arbitrary rolling off below 20Hz) in order to ensure phase accuracy in the bottom end. This, naturally, puts more constraint on the quality of the turntable used in the chain.

The overall feedback is less than 10 dB at 20Hz; Ensuring minimal dynamically induced distortions in the phono stage while maintaining the noise level down to - 80 dB (A-weighted) reference 5 m.v. input.

It is interesting to note that much superior RIAA accuracy with better noise figures can be achieved by employing higher feedback values. This, however, would be at the expense of inferior sonic quality and would detract from purist performance of the preamplifier.

b. Line Stage

This is a simple CE stage followed by a current pumping voltage amplifier. The overall feedback of this stage is less than 20 dB with an output impedance of 200 ohms.

c. The preamplifier module has a gain of 54 dB which is suitable for all moving magnet and high output moving coil cartridges.

d. Facilities

Only necessary controls and facilities have been provided where these will not detract from the purist quality of the preamplifier.

Two push buttons provide tape monitor and mono/stereo switching. An extremely high quality rotary switch is used to select the input (phono, tape and auxiliary).

A precision, low noise stepped potentiometer has been used for the volume control. Channel balance accuracy at each step from 0 dB down to -70 dB is better than 0.2 dB.

777 POWER AMPLIFIER

1. Construction

a. Mechanical:

The amplifier case is cast aluminium bearing the company logo in it's front panel. The logo acts largely as a heat sink, accelerating heat dissipation from the main heat sink block (which is formed as an extension of the ISSI into the case). In effect the whole casting works as a giant heat sink.

The inside of the amplifier is totally exposed by removing the top plate, which facilitates servicing of the unit. In general, there should not be any requirement to remove the chassis in order to change any major parts.

b. General:

The 777 has been designed to be totally modular in construction, while keeping the number of connectors to a minimum. This largely facilitates replacement of any defective parts with relative ease. The connectors used for this purpose are of the highest quality available.

The 777 utilizes two identical mono amplifiers, each fed from its own transformer and power supply module.

The layout of the two channels allows minimum lengths of wiring, while input/output connections are made through less than 2 inches of wire harness lengths.

c. Components:

1. All active components used in the 777 amplifier are discrete. Low power transistors are low noise, high gain x bandwidth and extremely reliable.

The output devices employed are high voltage H-FETs, with their E_t around 10MHz. This is to ensure that the bandwidth of the last stage is greater than that of the driving stages.

2. All resistors used in the power amplifier section are highest quality metal film, 1% tolerance and low noise. They are generally over-rated to ensure low thermal noise and biasing variations.

3. Power supply filtering is done by high ripple current, structurally sound and extremely reliable electrolytic capacitors. All decoupling capacitors used in the 777 are best quality polyester, to minimize high frequency roll-up effects.

4. Heavy duty connectors are used to connect DC to the power amplifier module, while gold plated connectors are employed for signal line connections to the back panel of the amplifier.

5. An instrument type line connector, incorporating a line fuse and line voltage selector card is used for safety and ease of transportation and handling.

2. Power Supply:

Each of the two mono power supplies comprises a specially designed, extremely low regulation transformer (200 volt-amperes at 3.5% regulation), feeding directly into the power supply module with extra heavy duty copper tracks and, typically, 35,000 microfarads of filtering capacity, decoupled by highest quality polyester capacitors for high frequency performance. This having very large bandwidth presents extremely low output impedance to the power amplifier, which accounts for the 777's superb reproduction of the full frequency spectrum of program material.

It is interesting to note that most designs tend to ignore the importance of the power supply in the reproduction of music; utilizing under-rated transformers with high regulation, use of low capacity and structurally weak electrolytic capacitors, not using small decoupling capacitors and/or use of low guage wires and interconnecting cables which will in turn add to the output impedance of the power supply.

3. Power Amplifier:

The 777 amplifier module is a perfectly symmetrical class "A" amplifier, except for output devices which operate in class "AB" mode. Symmetry has been achieved through cascading stages of the amplifier in alternate PNP/NPN complementary transistors, while drawing symmetrical currents from positive and negative rails.

The amplifier is DC coupled throughout, utilizing the same amount of feedback for both signal and DC. DC bias stability is achieved by the application of very high local feedback loops. This is also responsible for the large open loop bandwidth of the amplifier (230KHZ).

The source and load impedances of each stage have been matched carefully for optimum frequency response and minimum interstage distortion. Basically, two stages of voltage amplifier are used, these being separated by a

unity gain cascade stage as a buffer.

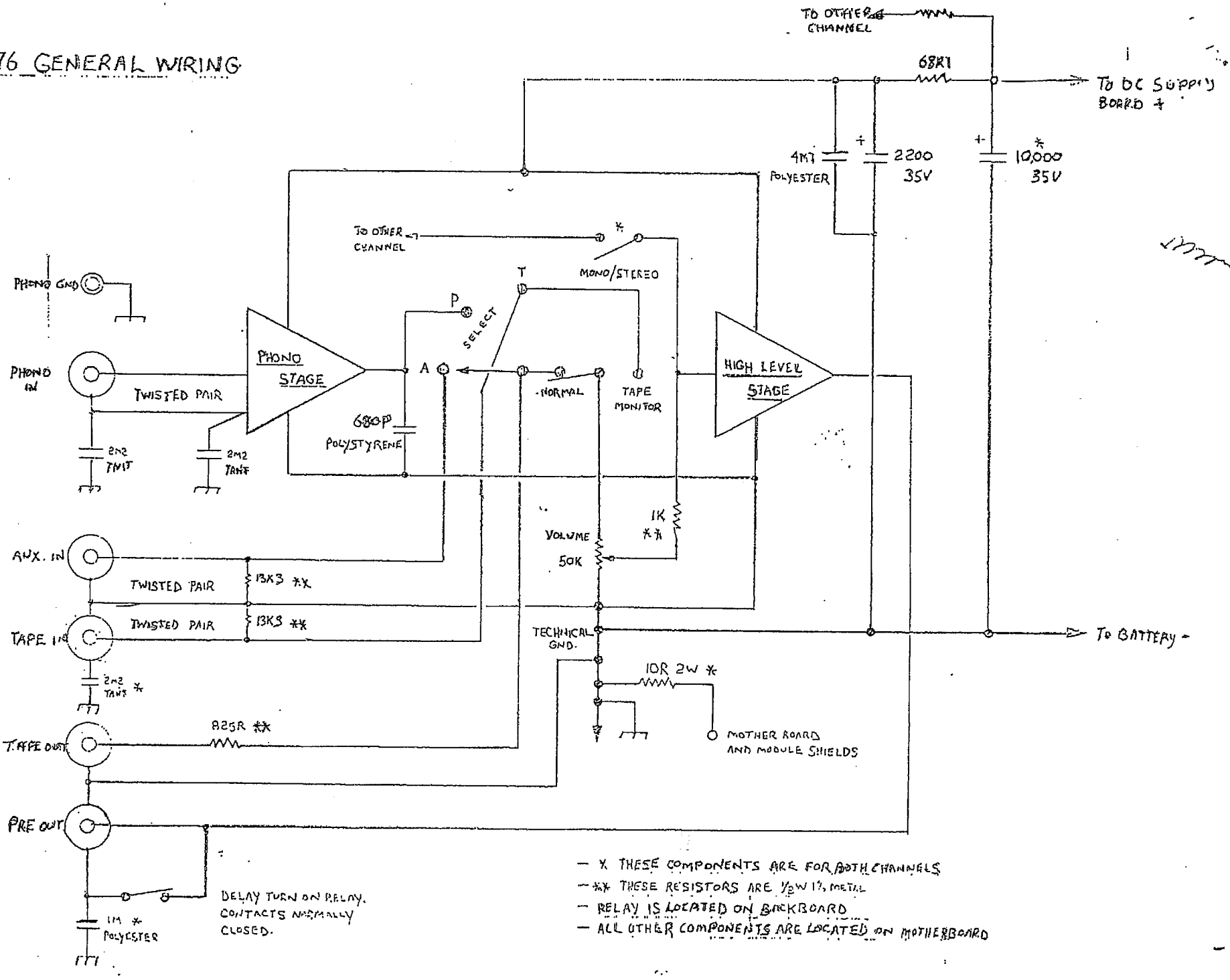
Zobel or half zobel networks are normally used in all designs of power amplifiers to reduce the THD measured at the higher end of the spectrum and, while rendering the amplifier more stable under highly reactive loads, limits the power bandwidth available to the load, detracting from purist quality of reproduction. Due to the inherently stable design of the 777, it was not necessary to use such networks or any type of output filtering as such. This affords an actual high frequency roll-off behaviour of 6db/octave to amplifier/loudspeaker combination.

The 777 is an inverting amplifier. This has been done to ensure a much lower common mode slewing difference between positive and negative swings of the output.

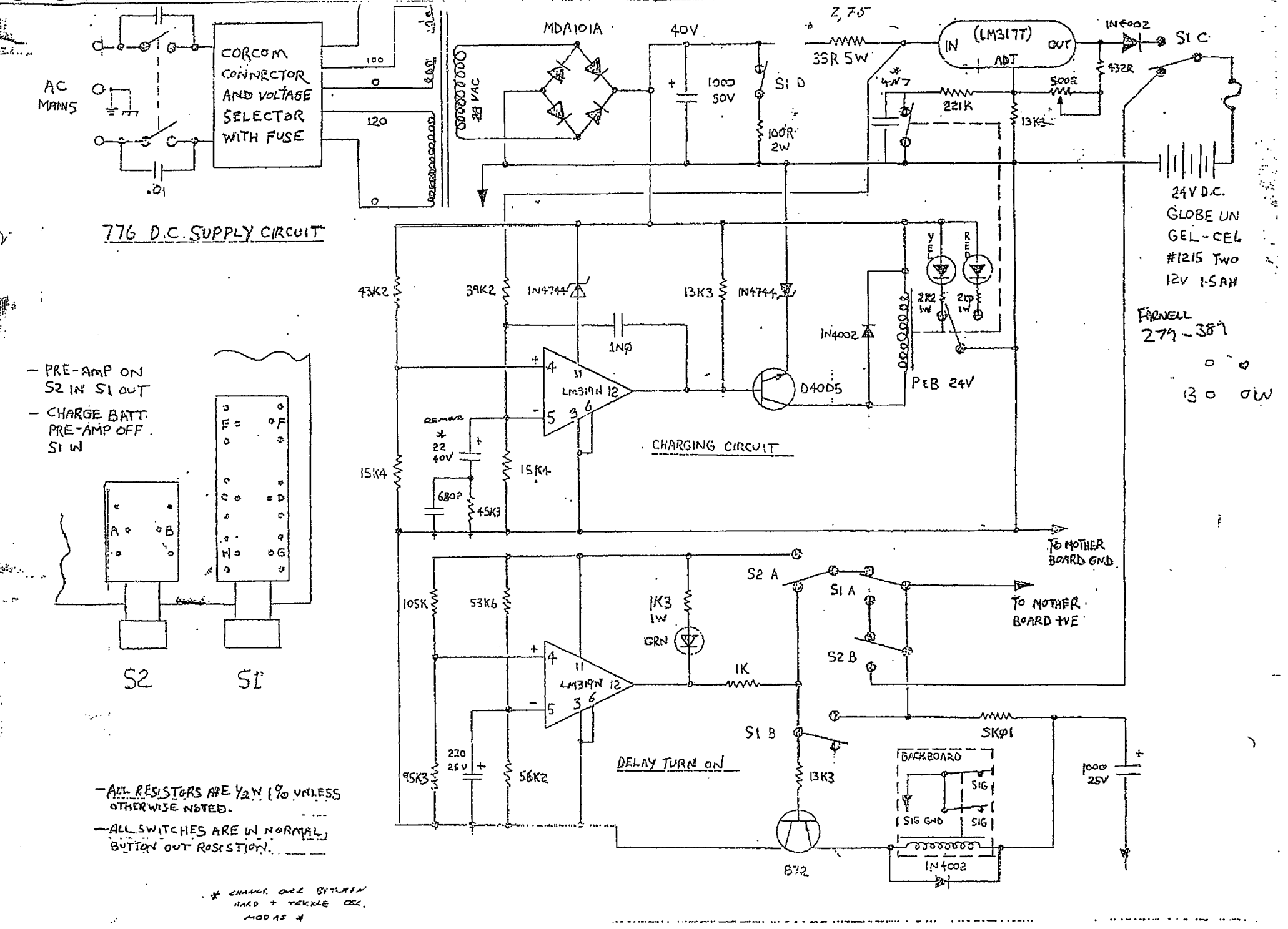
Overall feedback employed in the 777 is a mere 14db, which is very low by any standards. This provides THD figures of less than 0.2% from DC up to 40KHZ, and a closed loop bandwidth of 1.15MHZ.

Protection is provided for both the power amplifier and speakers through an output fuse which has been incorporated in the feedback loop in order to reduce its adverse effects by a factor of 5:1. Considering that the 777 is an extremely robust and reliable amplifier, it was envisaged that this type of protection is ample for 99% of the situation where some type of protection is required.

776 GENERAL WIRING



— * THESE COMPONENTS ARE FOR BOTH CHANNELS
— ** THESE RESISTORS ARE ½W 1% METAL
— RELAY IS LOCATED ON BACKBOARD
— ALL OTHER COMPONENTS ARE LOCATED ON MOTHERBOARD

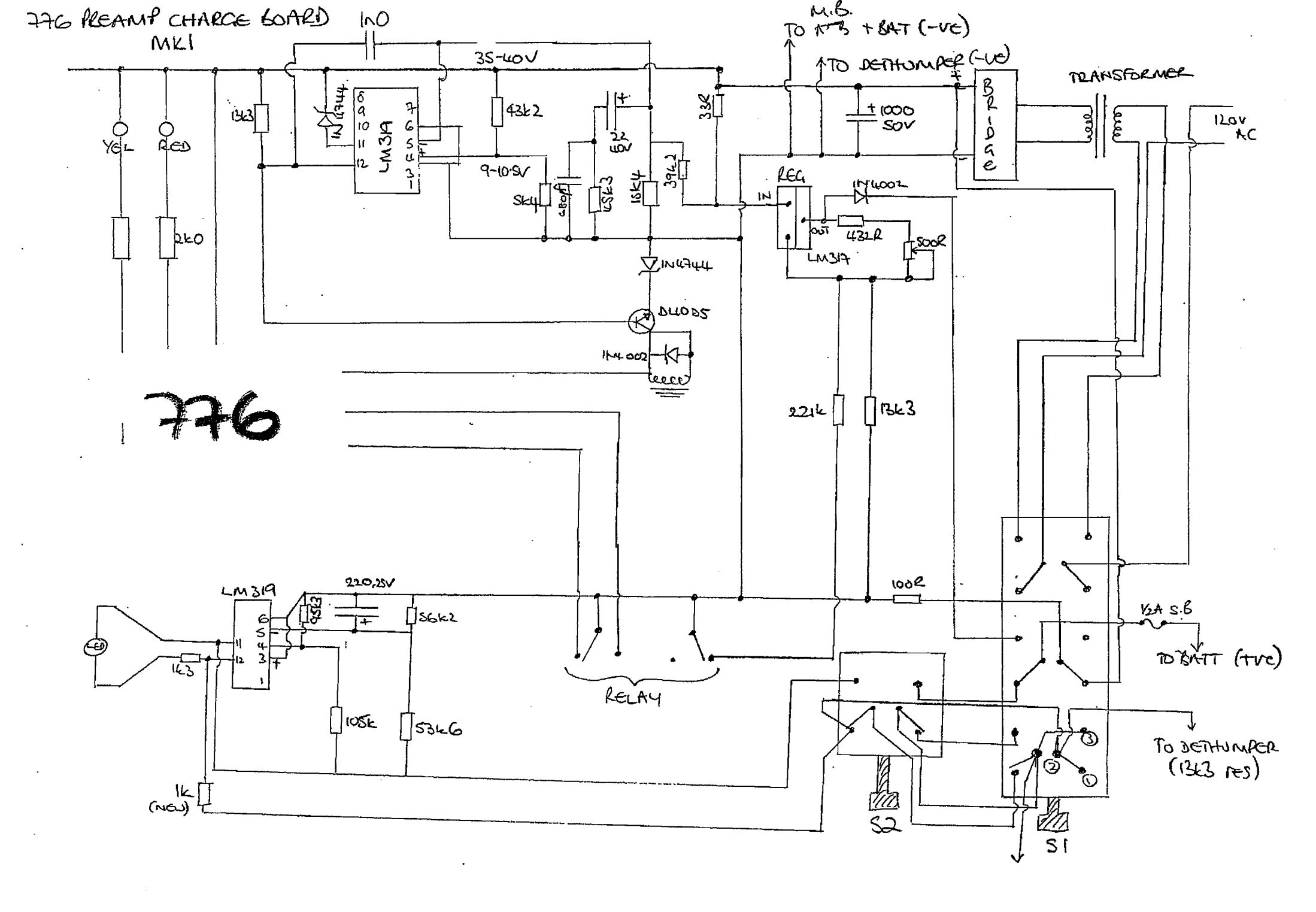


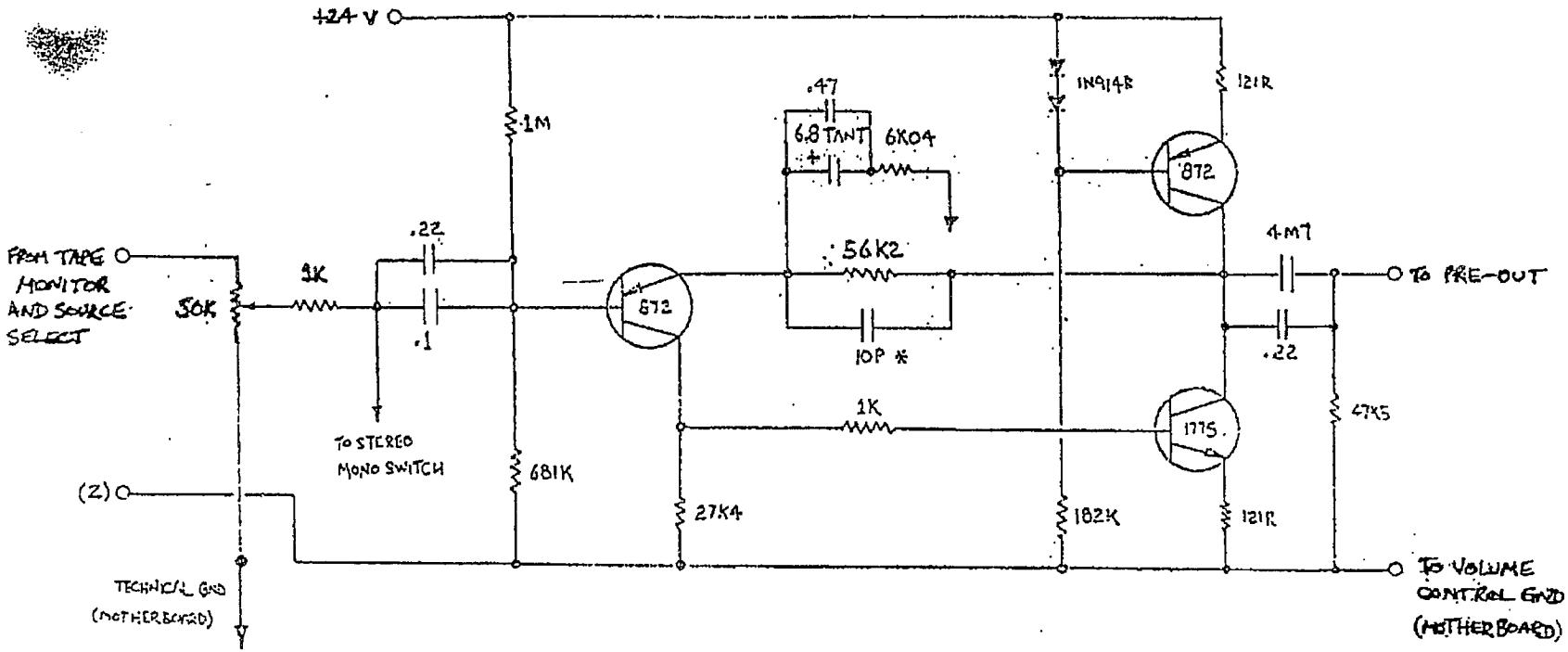
776 D.C. SUPPLY CIRCUIT

- PRE-AMP ON S2 IN S1 OUT
- CHARGE BATT PRE-AMP OFF S1 IN

- ALL RESISTORS ARE ½W 1% UNLESS OTHERWISE NOTED.
- ALL SWITCHES ARE IN NORMAL BUTTON OUT POSITION.

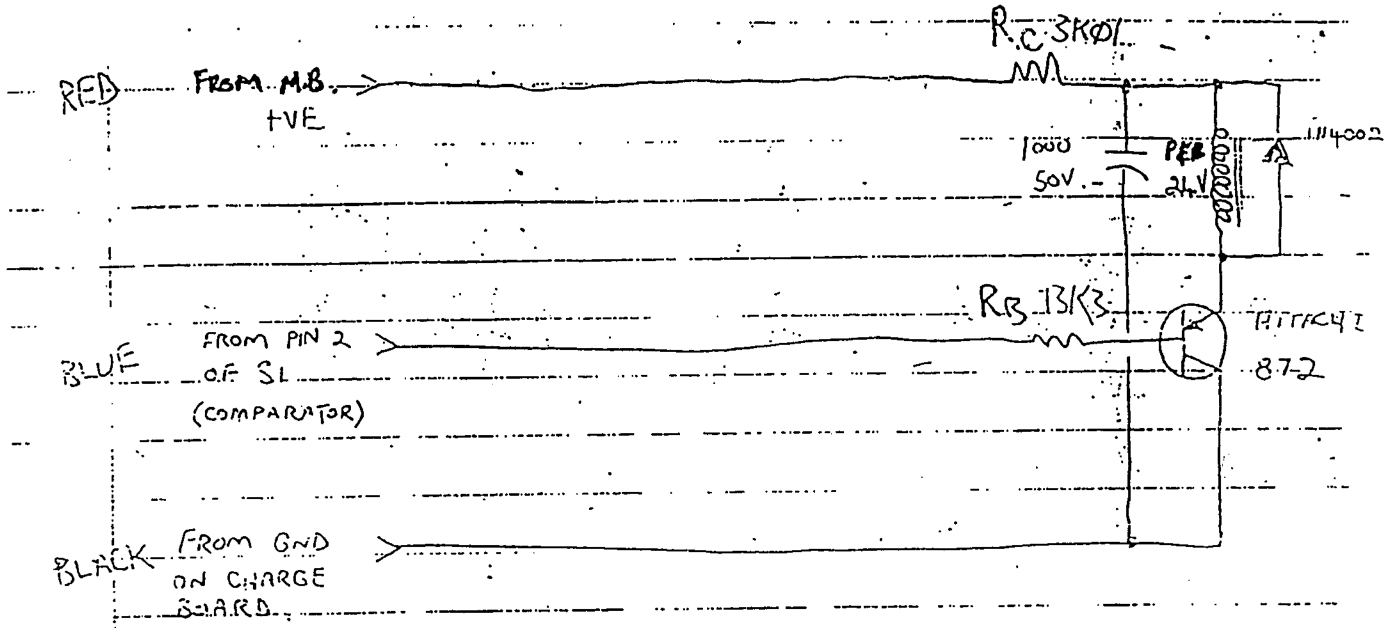
* CHANGE OSC BOARD HARD + TACKLE OSC. MODAS #

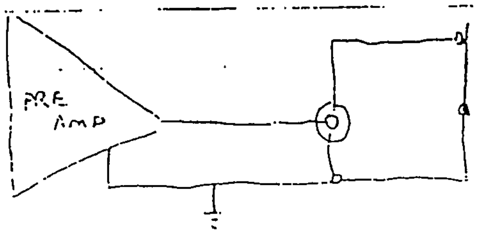

776 PREAMP CHARGE BOARD MK1
IN0
35-40V
M.B.
TO +BAT (-VE)
TO DETHUMPER (-VE)
TRANSFORMER
12OV AC
BRIDGE
1000 50V
LM319
43k2
9-10·5V
6·2 6V
33R
3k42
15k4
5k4
68nF
6k83
IN4744
IN4002
REG
LM317
432R
500R
DL4005
YEL
RED
2k0
1k3
221k
13k3
100R
220,25V
56k2
105k
53k6
1k (NGV)
RELAY
S2
S1
1A S.B
TO BATT (+VE)
TO DETHUMPER (1k3 RES)
776



HIGH LEVEL STAGE M.C./M.M

DETHUMPER

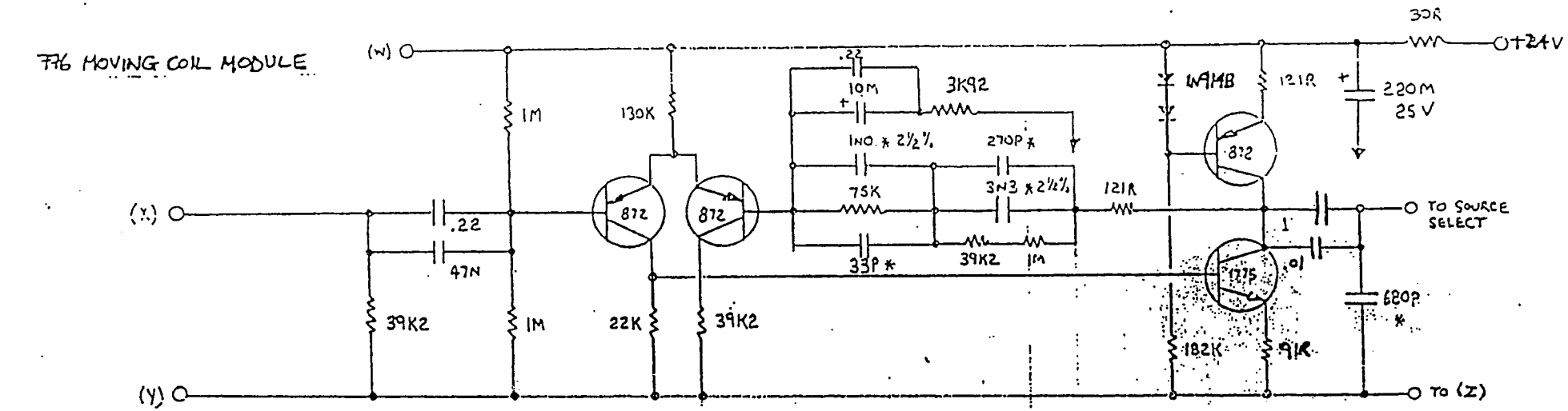


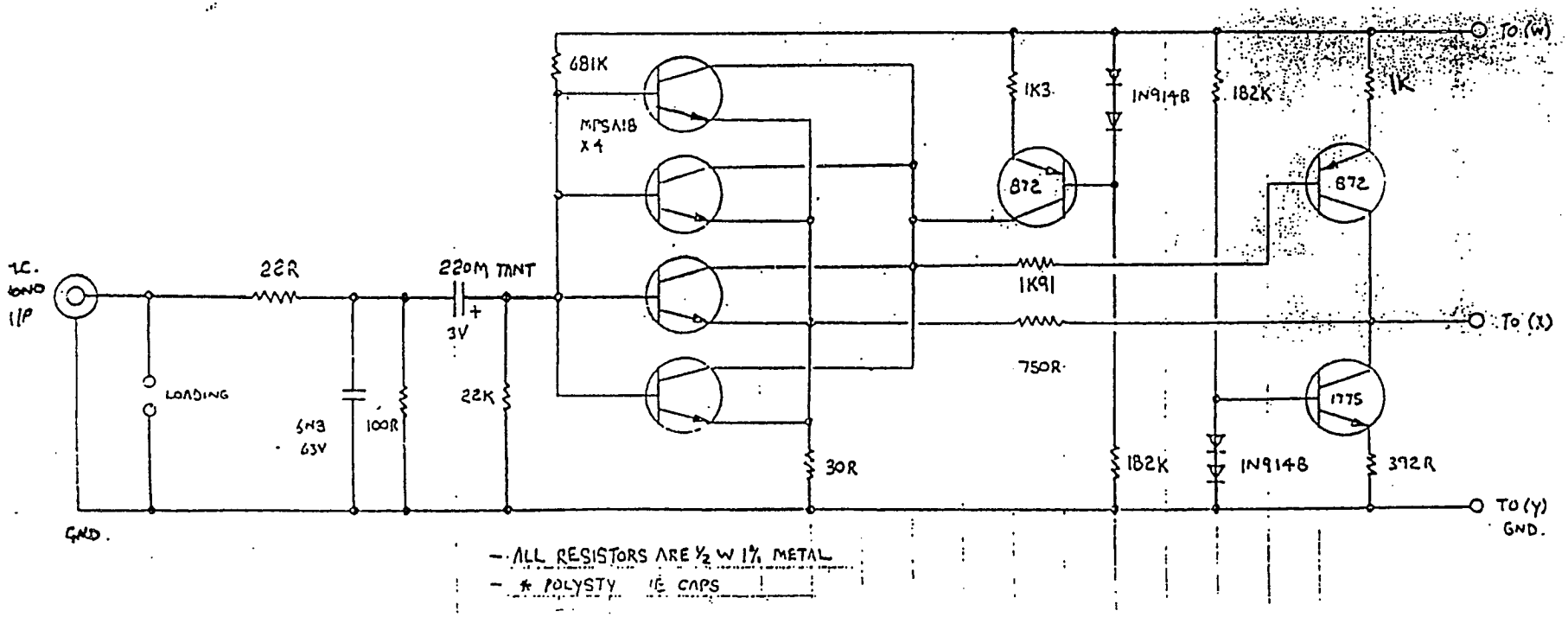


RELAY CONTACTS (ONE CH)
NORMALLY CLOSED (RELAY OFF)

P. J. [signature] OCT. 81

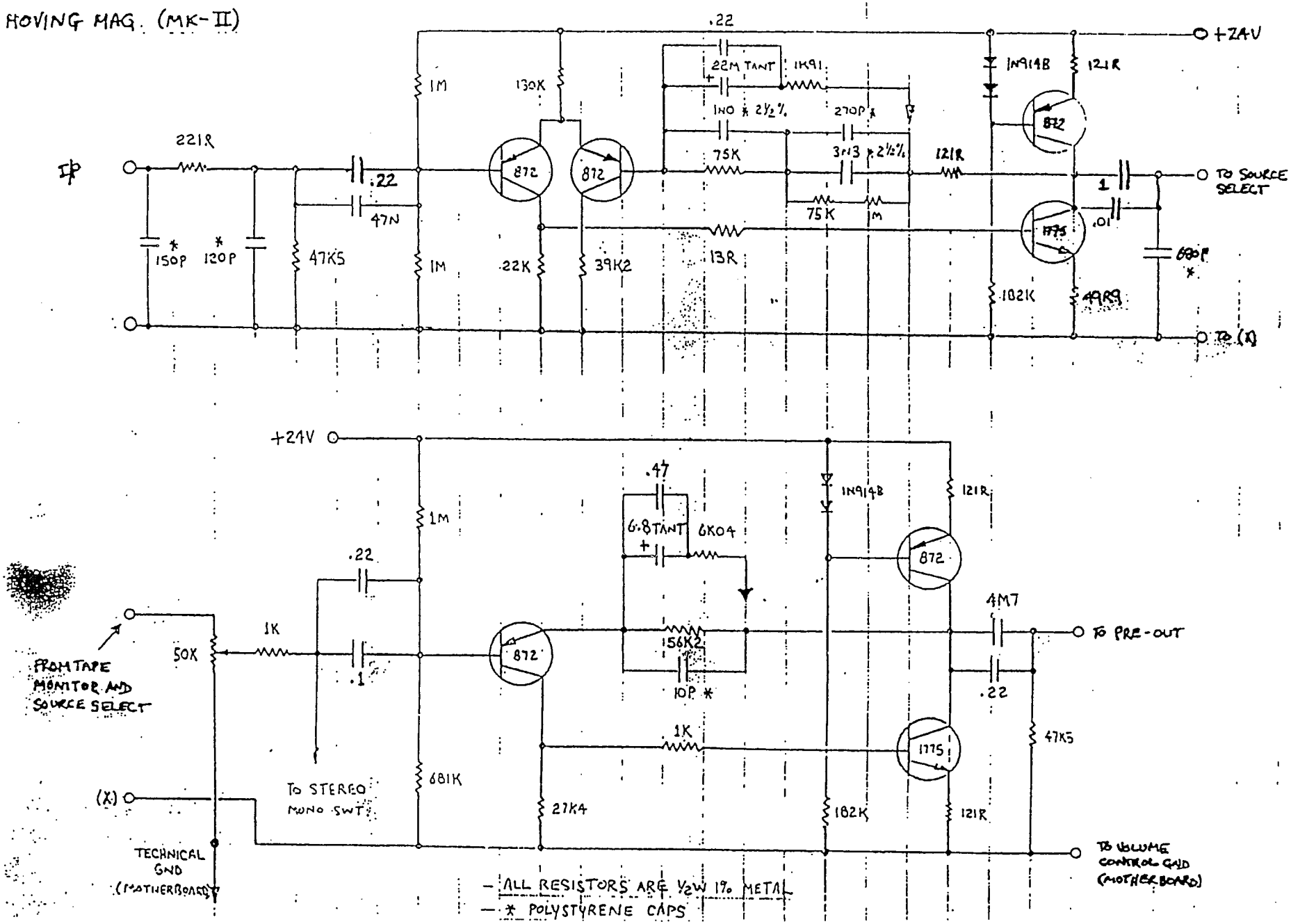
776 MOVING COIL MODULE

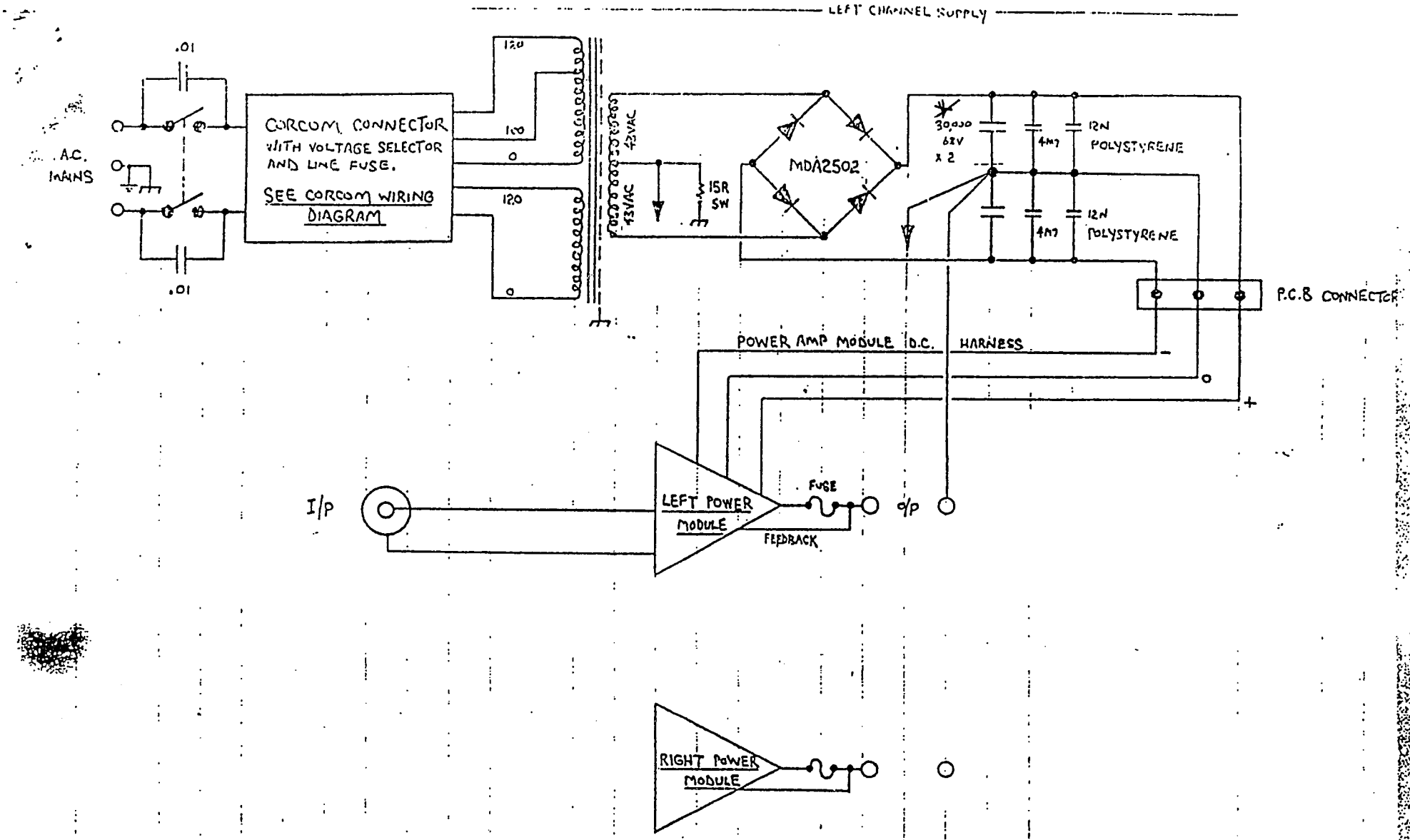




- ALL RESISTORS ARE ½ W 1% METAL
- * POLYSTY 1% CAPS

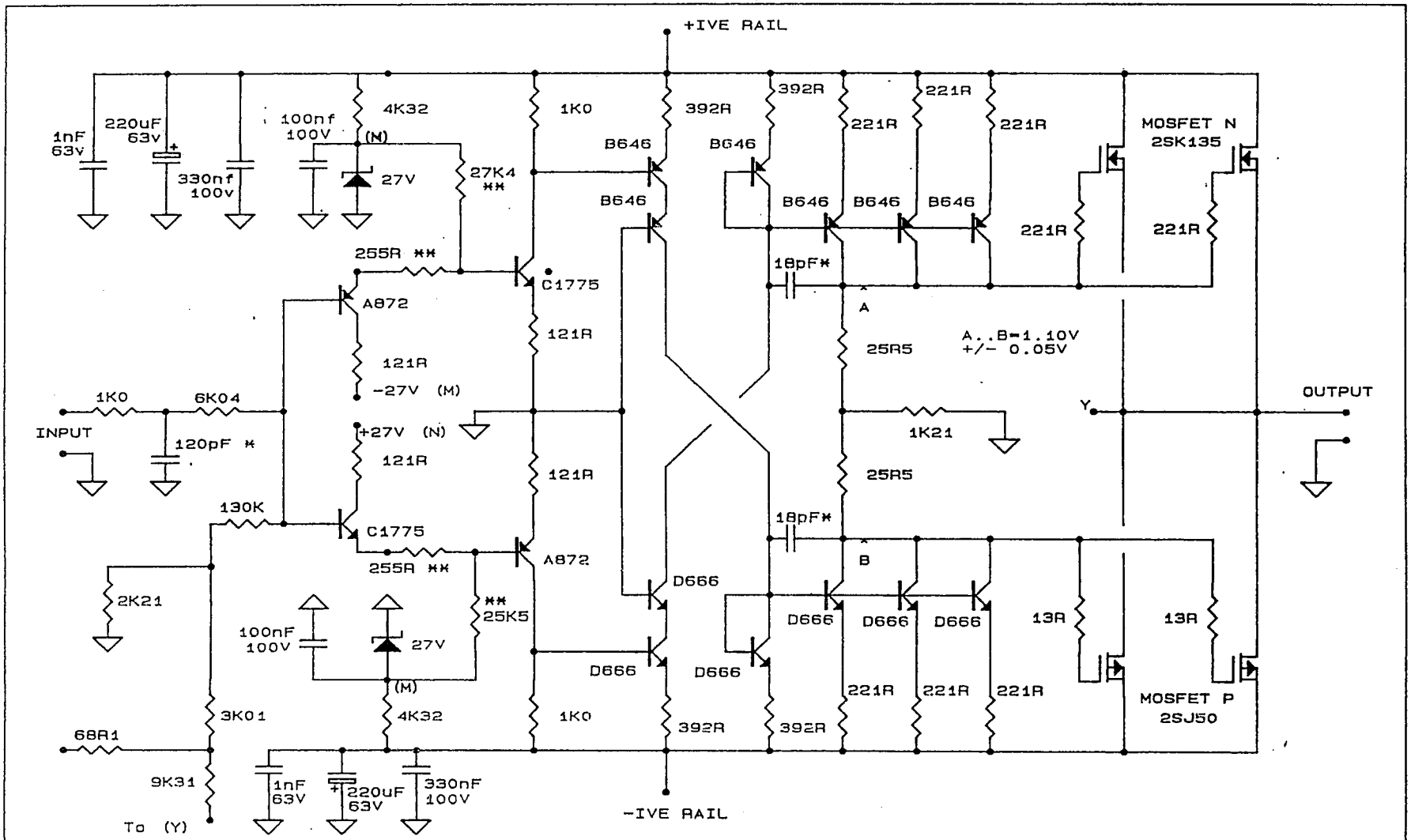
% MOVING MAG. (MK-II)





777 POWER SUPPLY WIRING

* 777 BU VERSION – 30,000NF 63V x4

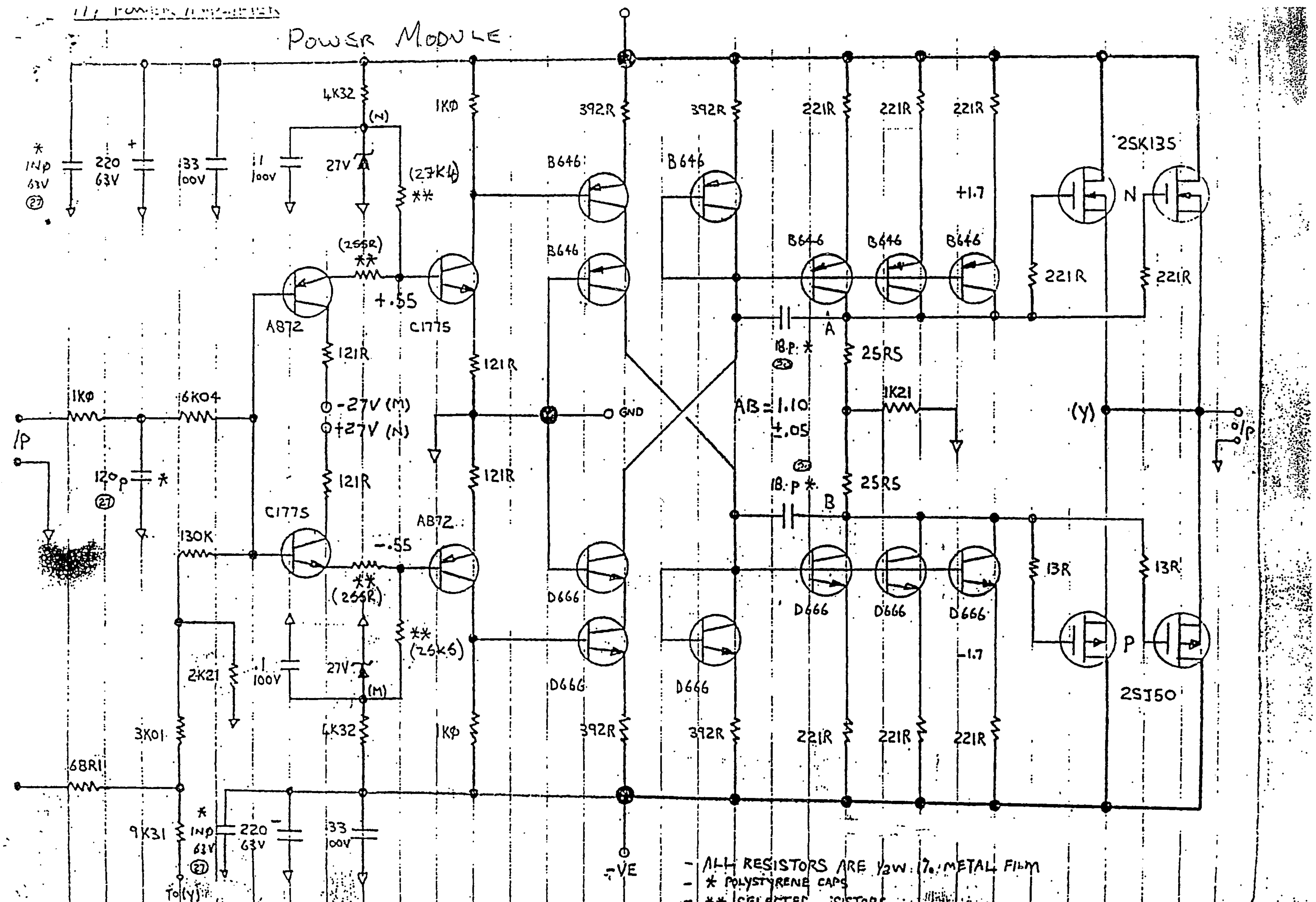


All resistors are 1/2W 1% metal film

* Polystyrene caps

** Selected resistors

MISSION ELECTRONICS		
Title: MISSION 777 POWER AMP		
Size: A	Document Number	REV
Date: June 25, 1990	Sheet of	


POWER MODULE
4K32
(N)
1KΦ
392R
221R
2SK135
N
*
1NP
63V
27
220
63V
+
33
100V
.1
100V
27V
(27K4)
**
B646
+1.7
(256R)
+.55
A872
C1775
221R
A
18.P. *
25RS
121R
1KΦ
6K04
-27V (M)
+27V (N)
GND
AB=1.10
4.05
1K21
(Y)
o/P
I/P
120p
130K
C1775
AB72
-.55
(256R)
(25K6)
D666
13R
P
2K21
27V
(M)
-1.7
2SJ50
3K01
68R1
9K31
To (Y)
-VE
B
- ALL RESISTORS ARE 1/2W 1% METAL FILM
- * POLYSTYRENE CAPS
- ** SELECTED RESISTORS

2SC1775, 2SC1775A

Silicon NPN Epitaxial

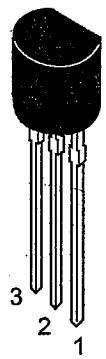
HITACHI

Application

- Low frequency low noise amplifier
- Complementary pair with 2SA872/A

Outline

TO-92 (1)



1. Emitter
2. Collector
3. Base

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	2SC1775	2SC1775A	Unit
Collector to base voltage	V_{CBO}	90	120	V
Collector to emitter voltage	V_{CEO}	90	120	V
Emitter to base voltage	V_{EBO}	5	5	V
Collector current	I_C	50	50	mA
Collector power dissipation	P_C	300	300	mW
Junction temperature	Tj	150	150	°C
Storage temperature	Tstg	–55 to +150	–50 to +150	°C

Electrical Characteristics (Ta = 25°C)

		2SC1775			2SC1775A				
Item	Symbol	Min	Typ	Max	Min	Typ	Max	Unit	Test conditions
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	90	—	—	120	—	—	V	I_C = 1 mA, R_{BE} = ∞
Collector cutoff current	I_{CBO}	—	—	0.5	—	—	—	µA	V_{CB} = 75 V, I_E = 0
		—	—	—	—	—	0.5	µA	V_{CB} = 100 V, I_E = 0
DC current transfer ratio	h_{FE1}*1	400	—	1200	400	—	1200		V_{CE} = 12 V, I_C = 2 mA
	h_{FE2}	160	—	—	160	—	—		V_{CE} = 12 V, I_C = 0.1 mA
Base to emitter voltage	V_{BE}	—	—	0.75	—	—	0.75	V	V_{CE} = 12 V, I_C = 2 mA
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	0.5	—	—	0.5	V	I_C = 10 mA, I_B = 1 mA
Gain bandwidth product	f_T	—	200	—	—	200	—	MHz	V_{CE} = 12 V, I_C = 2 mA
Collector output capacitance	Cob	—	1.6	—	—	1.6	—	pF	V_{CB} = 25 V, I_E = 0, f = 1 MHz
Noise figure	NF	—	—	5.0	—	—	5.0	dB	V_{CE} = 6 V, I_C = 50 µA, R_g = 50 kΩ, f = 10 Hz
		—	—	1.5	—	—	1.5	dB	f = 1 kHz

Note: 1. The 2SC1775/A is grouped by h_{FE1} as follows.

E	F
400 to 800	600 to 1200

2SA872, 2SA872A

Silicon PNP Epitaxial

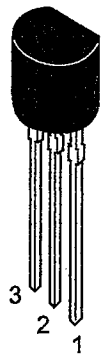
HITACHI

Application

- Low frequency low noise amplifier
- Complementary pair with 2SC1775/A

Outline

TO-92 (1)



1. Emitter
2. Collector
3. Base

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	2SA872	2SA872A	Unit
Collector to base voltage	V_{CBO}	–90	–120	V
Collector to emitter voltage	V_{CEO}	–90	–120	V
Emitter to base voltage	V_{EBO}	–5	–5	V
Collector current	I_C	–50	–50	mA
Collector power dissipation	P_C	300	300	mW
Junction temperature	Tj	150	150	°C
Storage temperature	Tstg	–55 to +150	–50 to +150	°C

Electrical Characteristics (Ta = 25°C)

		2SA872			2SA872A				
Item	Symbol	Min	Typ	Max	Min	Typ	Max	Unit	Test conditions
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	–90	—	—	–120	—	—	V	I_C = –1 mA, R_{BE} = ∞
Collector cutoff current	I_{CBO}	—	—	–0.5	—	—	—	µA	V_{CB} = –75 V, I_E = 0
		—	—	—	—	—	–0.5	µA	V_{CE} = –100 V, I_E = 0
DC current tamsfer ratio	h_{FE1}*1	250	—	800	250	—	800		V_{CE} = –12 V, I_C = –2 mA
	h_{FE2}	160	—	—	160	—	—		V_{CE} = –12 V, I_C = –0.1 mA
Base to emitter voltage	V_{BE}	—	—	–0.75	—	—	–0.75	V	V_{CE} = –12 V, I_C = –2 mA
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	–0.5	—	—	–0.5	V	I_C = –10 mA, I_B = –1 mA
Gain bandwidth product	f_T	—	120	—	—	120	—	MHz	V_{CE} = –12 V, I_C = –2 mA
Collector output capacitance	Cob	—	1.8	—	—	1.8	—	pF	V_{CB} = –25 V, I_E = 0, f = 1 MHz
Noise figure	NF	—	—	5.0	—	—	5.0	dB	V_{CE} = –6 V, I_C = –50 µA, R_g = 50 kΩ, f = 10 Hz
		—	—	1.5	—	—	1.5	dB	f = 1 kHz

Note: 1. The 2SA872/A is grouped by h_{FE1} as follows.

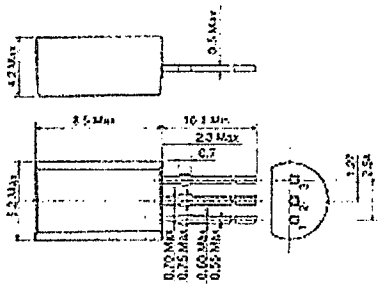
D	E
250 to 500	400 to 800

HITACHI

2SD666, 2SD666A

SILICON NPN EPITAXIAL

LOW FREQUENCY HIGH VOLTAGE AMPLIFIER
Complementary pair with 2SB646/A

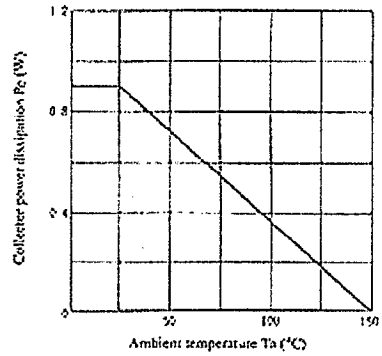


(JEDEC TO-92 MOD.)

■ ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Item	Symbol	2SD666	2SD666A	Unit
Collector to base voltage	V_{CBO}	120	120	V
Collector to emitter voltage	V_{CEO}	80	100	V
Emitter to base voltage	V_{EBO}	5	5	V
Collector current	I_C	50	50	mA
Collector peak current	$i_{C(peak)}$	100	100	mA
Collector power dissipation	P_C	0.9	0.9	mW
Junction temperature	T_j	150	150	°C
Storage temperature	T_{stg}	−55 to +150	−55 to +150	°C

MAXIMUM COLLECTOR DISSIPATION CURVE



■ ELECTRICAL CHARACTERISTICS (T_a=25°C)

Item	Symbol	Test Condition	2SD666 min.	2SD666 typ.	2SD666 max.	2SD666A min.	2SD666A typ.	2SD666A max.	Unit
Collector to base breakdown voltage	$V_{(BR)CBO}$	I_C = 10μA, I_E = 0	120	—	—	120	—	—	V
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	I_C = 1mA, R_{BE} = ∞	80	—	—	100	—	—	V
Emitter to base breakdown voltage	$V_{(BR)EBO}$	I_E = 10μA, I_C = 0	5	—	—	5	—	—	V
Collector cutoff current	I_{CBO}	V_{CB} = 100V, I_E = 0	—	—	10	—	—	10	μA
DC current transfer ratio	h_{FE1}*	V_{CE} = 5V, I_C = 10mA	60	—	320	60	—	200	
	h_{FE2}	V_{CE} = 5V, I_C = 1mA	30	—	—	30	—	—	
Collector to emitter saturation voltage	$V_{CE(sat)}$	I_C = 30mA, I_B = 3mA	—	—	2	—	—	2	V
Base to emitter voltage	V_{BE}	V_{CE} = 5V, I_C = 10mA	—	—	1.5	—	—	1.5	V
Gain bandwidth product	f_T	V_{CE} = 5V, I_C = 10mA	—	140	—	—	140	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = 10V, I_E = 0, f = 1MHz	—	3	—	—	3	—	pF

* The 2SD666 and 2SD666A are grouped by h_{FE1} as follows.

	B	C	D
2SD666	60 to 120	100 to 200	160 to 320
2SD666A	60 to 120	100 to 200	—

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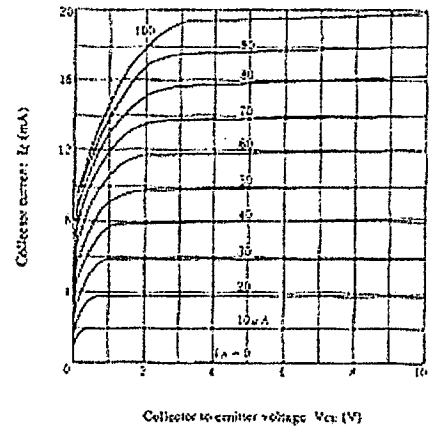
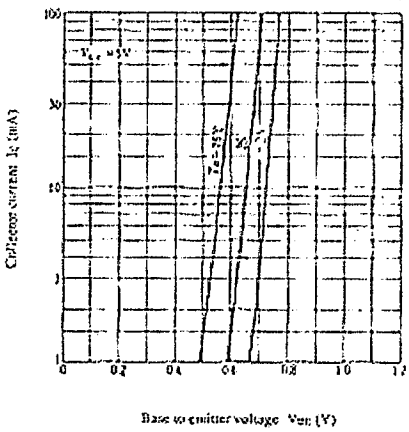
2SD666, 2SD666A

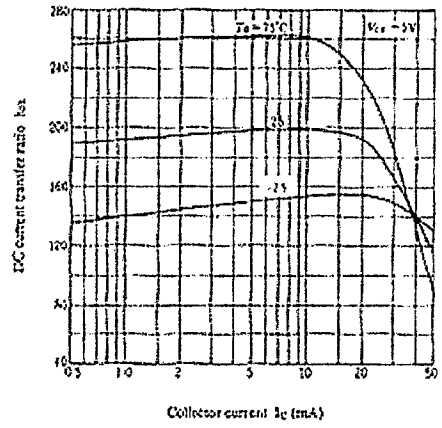
TYPICAL OUTPUT CHARACTERISTICS



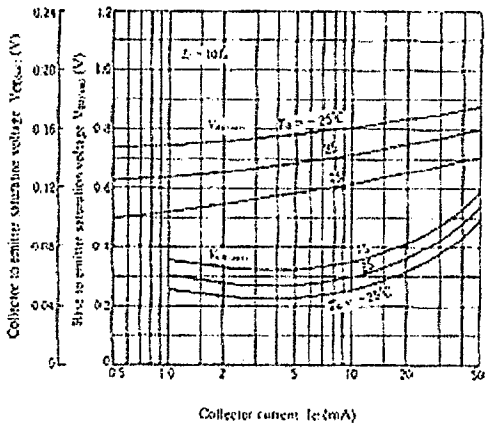
TYPICAL TRANSFER CHARACTERISTICS



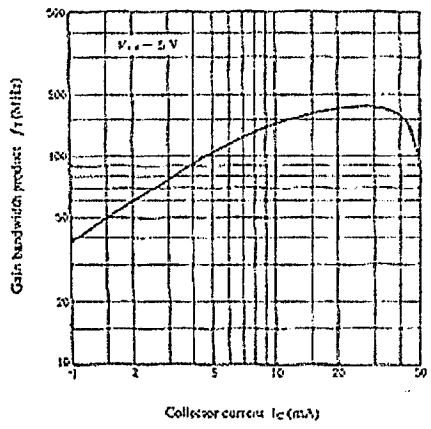
DC CURRENT TRANSFER RATIO VS. COLLECTOR CURRENT



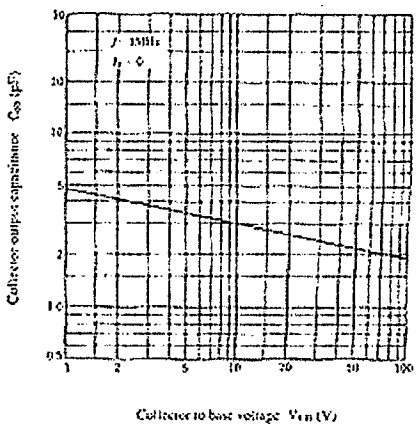
SATURATION VOLTAGE VS. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT VS. COLLECTOR CURRENT



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE

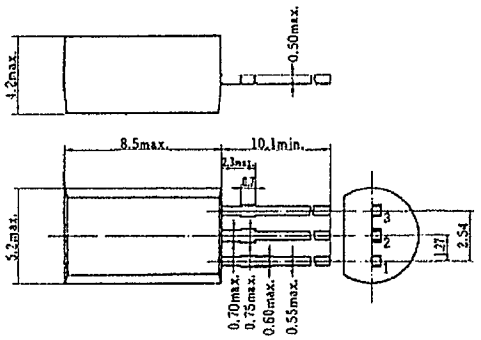


HITACHI

2SB646, 2SB646A

SILICON PNP EPITAXIAL

LOW FREQUENCY HIGH VOLTAGE AMPLIFIER
Complementary pair with 2SD666/A

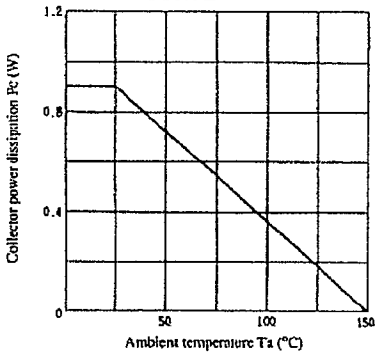


(JEDEC TO-92 MOD.)

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Item	Symbol	2SB646	2SB646A	Unit
Collector to base voltage	V_{CBO}	−120	−120	V
Collector to emitter voltage	V_{CEO}	−80	−100	V
Emitter to base voltage	V_{EBO}	−5	−5	V
Collector current	I_C	−50	−50	mA
Collector peak current	$I_{C(peak)}$	−100	−100	mA
Collector power dissipation	P_C	0.9	0.9	W
Junction temperature	T_j	150	150	°C
Storage temperature	T_{stg}	−55 to +150	−55 to +150	°C

MAXIMUM COLLECTOR DISSIPATION CURVE



■ ELECTRICAL CHARACTERISTICS (Ta=25°C)

Item	Symbol	Test Condition	2SB646			2SB646A			Unit
			min.	typ.	max.	min.	typ.	max.	
Collector to base breakdown voltage	$V_{(BR)CBO}$	I_C = −10μA, I_E = 0	−120	—	—	−120	—	—	V
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	I_C = −1mA, R_{BE} = ∞	−80	—	—	−100	—	—	V
Emitter to base breakdown voltage	$V_{(BR)EBO}$	I_E = −10μA, I_C = 0	−5	—	—	−5	—	—	V
Collector cutoff current	I_{CBO}	V_{CB} = −100V, I_E = 0	—	—	−10	—	—	−10	μA
DC current transfer ratio	h_{FE1}	V_{CE} = −5V, I_C = −10mA	60	—	320	60	—	200	
	h_{FE2}	V_{CE} = −5V, I_C = −1mA	30	—	—	30	—	—	
Collector to emitter saturation voltage	$V_{CE(sat)}$	I_C = −30mA, I_B = −3mA	—	—	−2	—	—	−2	V
Base to emitter voltage	V_{BE}	V_{CE} = −5V, I_C = −10mA	—	—	−1.5	—	—	−1.5	V
Gain bandwidth product	f_T	V_{CE} = −5V, I_C = −10mA,	—	140	—	—	140	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = −10V, I_E = 0, f = 1MHz	—	4	—	—	4	—	pF

* The 2SB646 and 2SB646A are grouped by h_{FE1} as follows.

	B	C	D
2SB646	60 to 120	100 to 200	160 to 320
2SB646A	60 to 120	100 to 200	—

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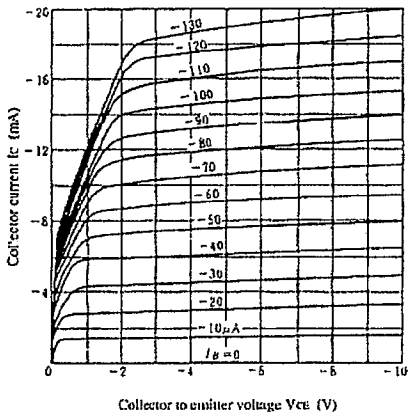
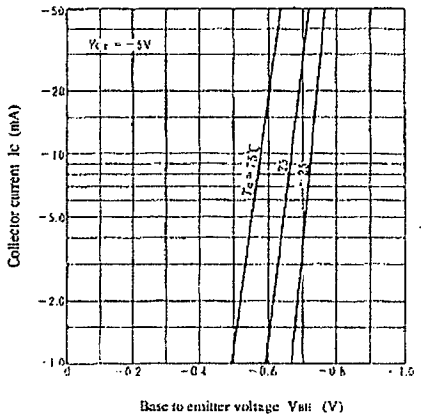
2SB646, 2SB646A

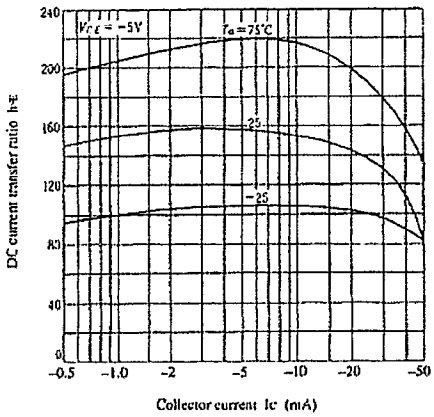
TYPICAL OUTPUT CHARACTERISTICS



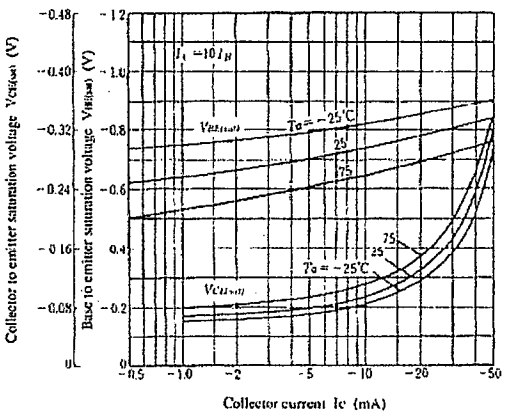
TYPICAL TRANSFER CHARACTERISTICS



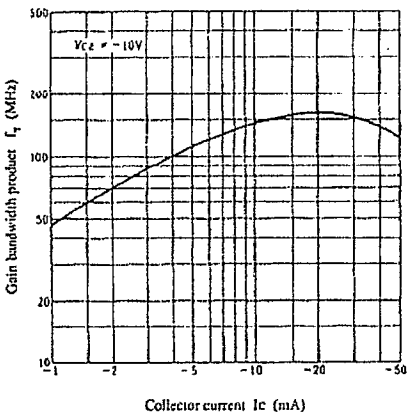
DC CURRENT TRANSFER RATIO VS. COLLECTOR CURRENT



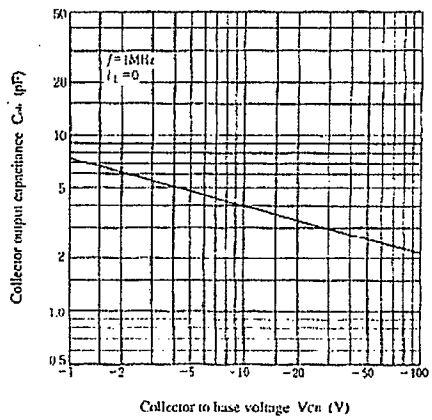
SATURATION VOLTAGE VS. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT VS. COLLECTOR CURRENT



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



2SK133, 2SK134, 2SK135

HITACHI/(OPTOELECTRONICS)

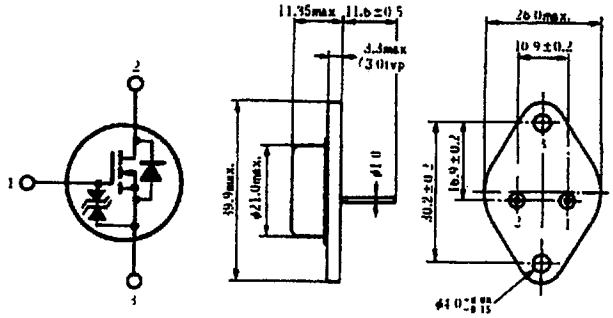
SILICON N-CHANNEL MOS FET

LOW FREQUENCY POWER AMPLIFIER

Complementary pair with 2SJ48, 2SJ49, 2SJ50

■ FEATURES

- High Power Gain.
- Excellent Frequency Response.
- High Speed Switching.
- Wide Area of Safe Operation.
- Enhancement-Mode.
- Good Complementary Characteristics.
- Equipped with Gate Protection Diodes.



1. Gate
2. Drain
3. Source (Case)

(Dimensions in mm)

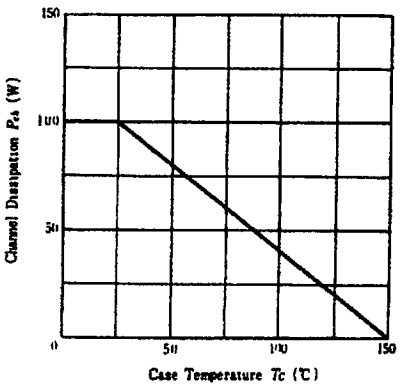
(JEDEC TO-3)

■ ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Item	Symbol	Rating			Unit
		2SK133	2SK134	2SK135	
Drain-Source Voltage	V_{DSX}	120	140	160	V
Gate-Source Voltage	V_{GSS}	±14			V
Drain Current	I_D	7			A
Body-Drain Diode Reverse Drain Current	I_{DR}	7			A
Channel Dissipation	P_{ch}*	100			W
Channel Temperature	T_{ch}	150			°C
Storage Temperature	T_{stg}	−55 ~ +150			°C

*Value at T_c=25 °C

POWER VS. TEMPERATURE DERATING

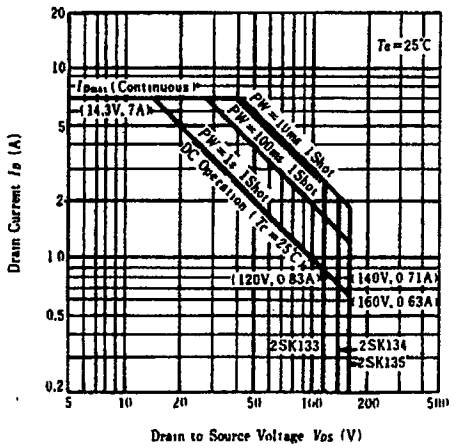


■ ELECTRICAL CHARACTERISTICS (T_a=25 °C)

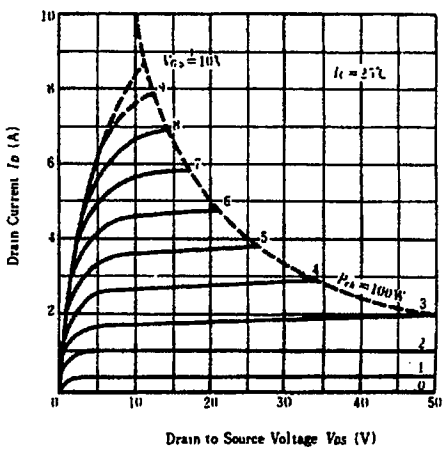
Item		Symbol	Test Condition	min.	typ.	max.	Unit
Drain-Source Breakdown Voltage	2SK133	$V_{(BR)DSX}$	I_D=10mA, V_{GS}=−10V	120	—	—	V
	2SK134			140	—	—	V
	2SK135			160	—	—	V
Gate-Source Breakdown Voltage		$V_{(BR)GSS}$	I_G=±100μA, V_{DS}=0	±14	—	—	V
Gate-Source Cutoff Voltage		$V_{GS(off)}$	I_D=100mA, V_{DS}=10V	0.15	—	1.45	V
Drain-Source Saturation Voltage		$V_{DS(sat)}$	I_D=7A, V_{GD}=0*	—	—	12	V
Forward Transfer Admittance		$\|y_{fs}\|$	I_D=3A, V_{DS}=10V*	0.7	1.0	1.4	S
Input Capacitance		C_{iss}	V_{GS}=−5V, V_{DS}=10V, f=1MHz	—	600	—	pF
Output Capacitance		C_{oss}		—	350	—	pF
Reverse Transfer Capacitance		C_{rss}		—	10	—	pF
Turn-on Time		t_{on}	V_{DD}=20V, I_D=4A	—	180	—	ns
Turn-off Time		t_{off}		—	60	—	ns

*Pulse Test

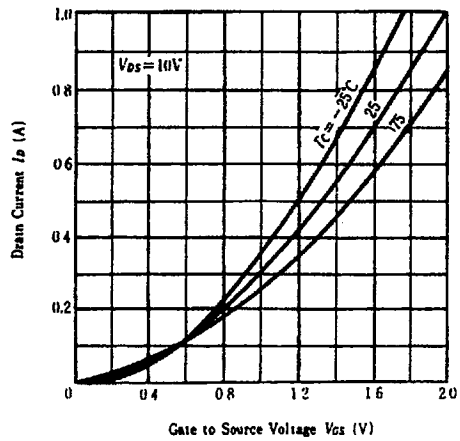
MAXIMUM SAFE OPERATION AREA



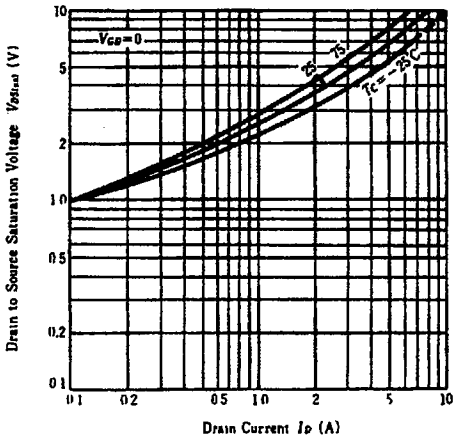
TYPICAL OUTPUT CHARACTERISTICS



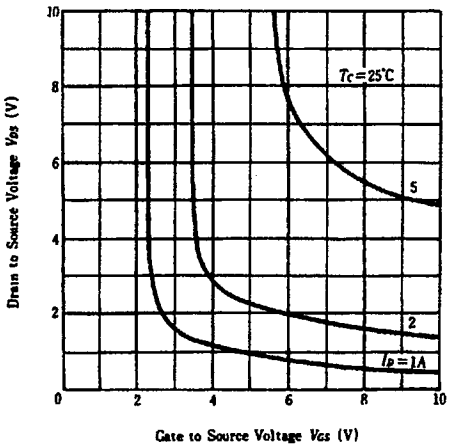
TYPICAL TRANSFER CHARACTERISTICS



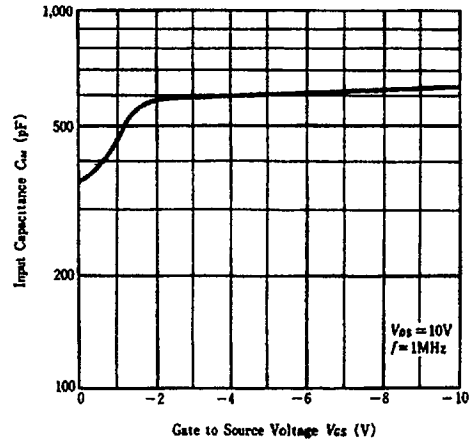
DRAIN - SOURCE SATURATION VOLTAGE VS. DRAIN CURRENT



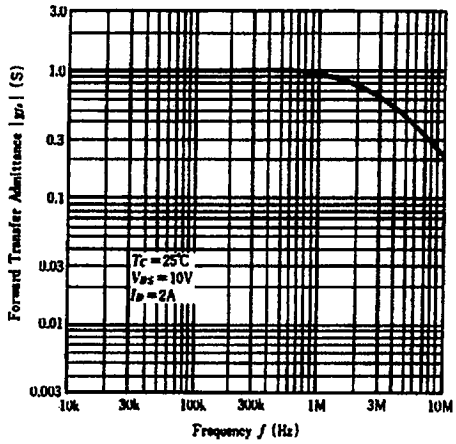
DRAIN - SOURCE VOLTAGE VS. GATE - SOURCE VOLTAGE



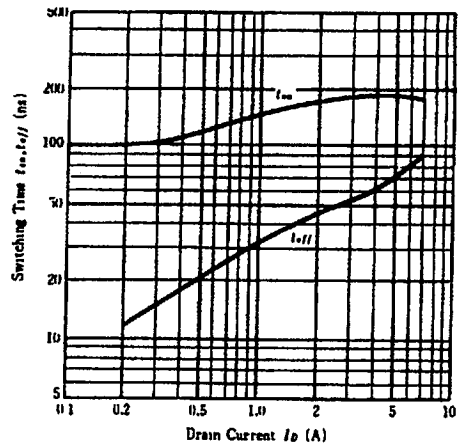
INPUT CAPACITANCE VS. GATE SOURCE VOLTAGE



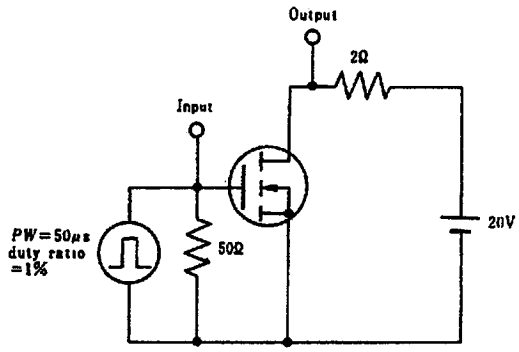
FORWARD TRANSFER ADMITTANCE VS. FREQUENCY



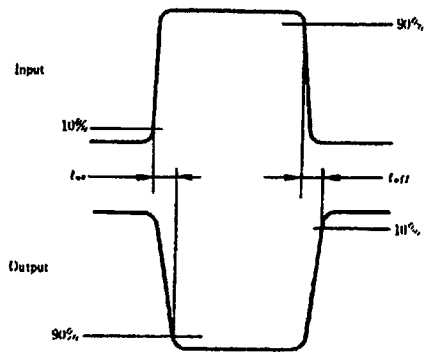
SWITCHING TIME VS. DRAIN CURRENT



SWITCHING TIME TEST CIRCUIT



WAVEFORMS



HITACHI/(OPTOELECTRONICS) 61E D

2SJ48,2SJ49,2SJ50

T-39-23

SILICON P-CHANNEL MOS FET

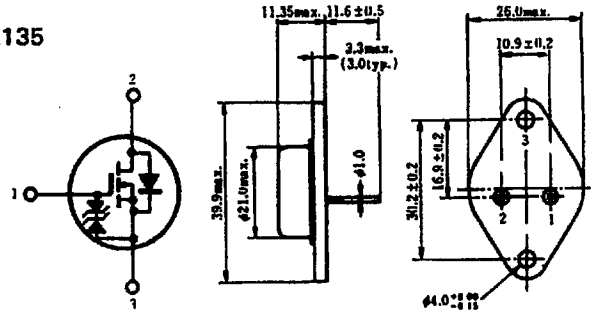
HITACHI/(OPTOELECTRONICS)

LOW FREQUENCY POWER AMPLIFIER

Complementary Pair with 2SK133, 2SK134, 2SK135

■ FEATURES

- High Power Gain.
- Excellent Frequency Response.
- High Speed Switching.
- Wide Area of Safe Operation.
- Enhancement-Mode.
- Good Complementary Characteristics.
- Equipped with Gate Protection Diodes.



1. Gate
2. Drain
3. Source (Case)

(JEDEC TO-3)

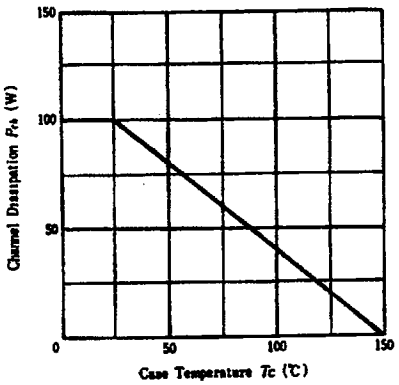
(Dimensions in mm)

■ ABSOLUTE MAXIMUM RATINGS (T_a=25 °C)

Item	Symbol	Rating			Unit
		2SJ48	2SJ49	2SJ50	
Drain-Source Voltage	V_{DSX}	−120	−140	−160	V
Gate-Source Voltage	V_{GSS}	±14			V
Drain Current	I_D	−7			A
Body-Drain Diode Reverse Drain Current	I_{DR}	−7			A
Channel Dissipation	P_{ch}*	100			W
Channel Temperature	T_{ch}	150			°C
Storage Temperature	T_{stg}	−55 ~ +150			°C

*Value at T_c=25 °C

POWER VS. TEMPERATURE DERATING

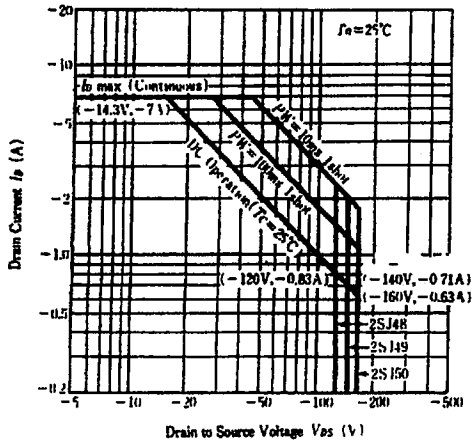


■ ELECTRICAL CHARACTERISTICS (T_a=25 °C)

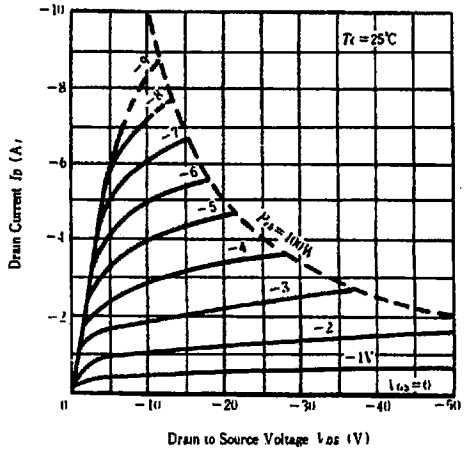
Item		Symbol	Test Condition	min.	typ.	max.	Unit
Drain-Source Breakdown Voltage	2SJ48	$V_{(BR)DSX}$	I_D=−10mA, V_{GS}=10V	−120	—	—	V
	2SJ49			−140	—	—	V
	2SJ50			−160	—	—	V
Gate-Source Breakdown Voltage		$V_{(BR)GSS}$	I_G=±100μA, V_{DS}=0	±14	—	—	V
Gate-Source Cutoff Voltage		$V_{GS(off)}$	I_D=−100mA, V_{DS}=−10V	−0.15	—	−1.45	V
Drain-Source Saturation Voltage		$V_{DS(sat)}$	I_D=−7A, V_{GD}=0*	—	—	−12	V
Forward Transfer Admittance		$\|Y_{fs}\|$	I_D=−3A, V_{DS}=−10V*	0.7	1.0	1.4	S
Input Capacitance		C_{iss}	V_{GS}=5V, V_{DS}=−10V, f=1MHz	—	900	—	pF
Output Capacitance		C_{oss}		—	400	—	pF
Reverse Transfer Capacitance		C_{rss}		—	40	—	pF
Turn-on Time		t_{on}	V_{DD}=−20V, I_D=−4A	—	230	—	ns
Turn-off Time		t_{off}		—	110	—	ns

*Pulse Test

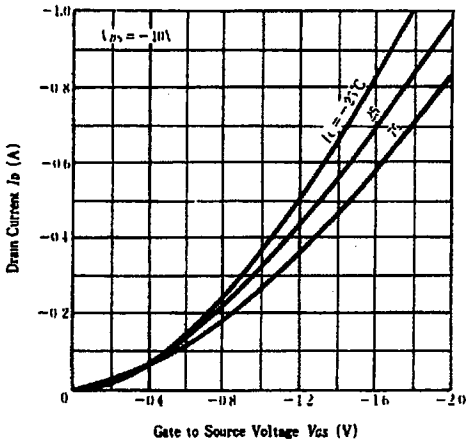
MAXIMUM SAFE OPERATION AREA



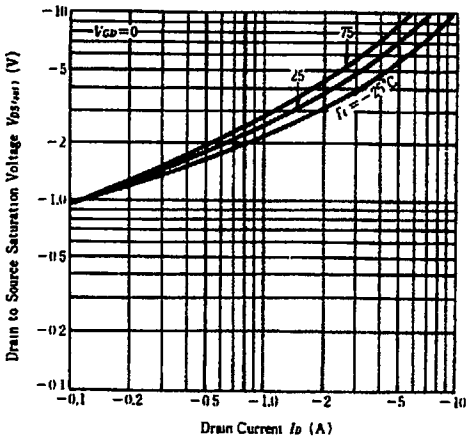
TYPICAL OUTPUT CHARACTERISTICS



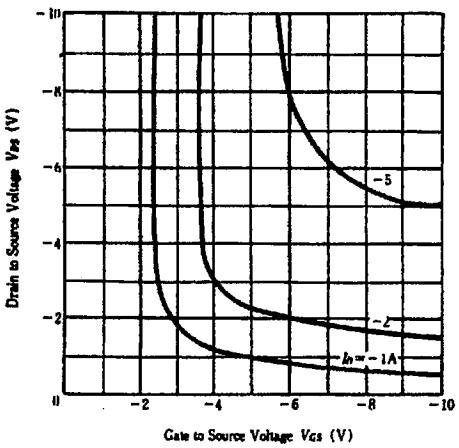
TYPICAL TRANSFER CHARACTERISTICS



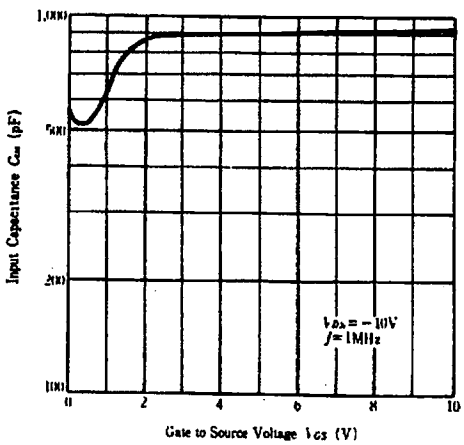
DRAIN TO SOURCE SATURATION VOLTAGE VS. DRAIN CURRENT



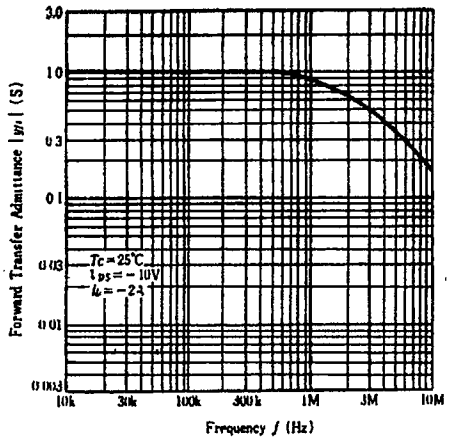
DRAIN TO SOURCE VOLTAGE VS. GATE TO SOURCE VOLTAGE



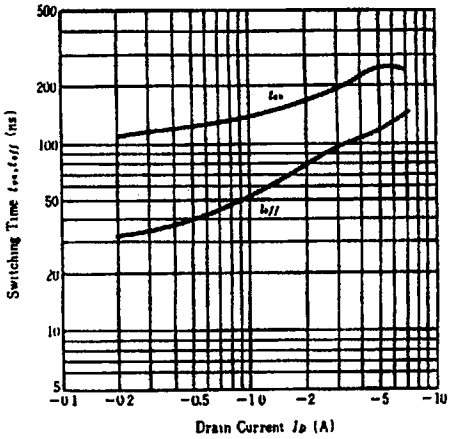
INPUT CAPACITANCE VS. GATE TO SOURCE VOLTAGE



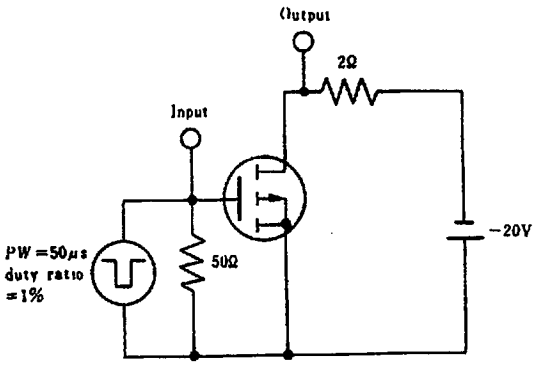
FORWARD TRANSFER ADMITTANCE VS. FREQUENCY



SWITCHING TIME VS. DRAIN CURRENT



SWITCHING TIME TEST CIRCUIT



WAVEFORMS