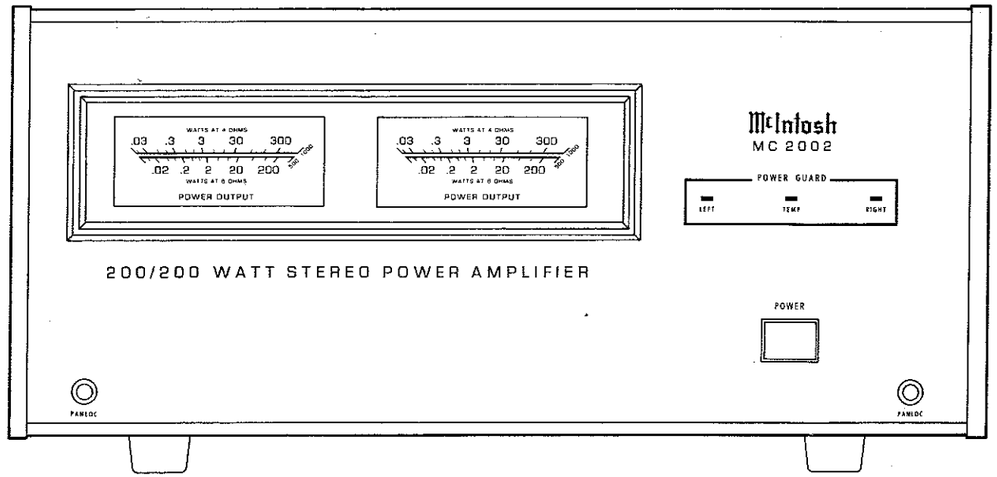
MC 2002

STEREO POWER AMPLIFIER



CONTENTS

McIntosh® Service Manual

Performance Specifications

McIntosh audio power ratings are in accordance with the Federal Trade Commission Regulation of November 4, 1974 concerning power output claims for amplifiers used in home entertainment products.

STEREO POWER OUTPUT
200 watts into 8 ohm loads or
300 watts into 4 ohm loads is the minimum sine wave continuous average power output per channel for 20 Hz to 20,000 Hz with both channels operating, which is:
40.0 volts RMS across 8 ohms or
34.6 volts RMS across 4 ohms.

MONO (BRIDGED) POWER OUTPUT
600 watts into an 8 ohm load is the minimum sine wave continuous average power output from 20 Hz to 20,000 Hz, which is:
69.3 volts RMS across 8 ohms.

OUTPUT LOAD IMPEDANCE
STEREO 4 ohms to 8 ohms
MONO 8 ohms obtained by connecting across the output terminals of both channels.

RATED POWER BAND
20 Hz to 20,000 Hz

TOTAL HARMONIC DISTORTION
STEREO 0.01% maximum harmonic distortion at any power level from 250 milliwatts to rated power from 20 Hz to 20,000 Hz with both channels operating.
MONO 0.01% maximum harmonic distortion at any power level from 250 milliwatts to rated power from 20 Hz to 20,000 Hz.

INTERMODULATION DISTORTION
STEREO 0.01% maximum at any power level from 250 milliwatts to rated power with both channels operating, for any combination of frequencies from 20 Hz to 20,000 Hz.
MONO 0.01% maximum at any power level from 250 milliwatts to rated power, for any combination of frequencies from 20 Hz to 20,000 Hz.

FREQUENCY RESPONSE (at one watt output)
+0, −0.25dB from 20 Hz to 20,000 Hz
+0, −3.0dB from 10 Hz to 100,000 Hz

HUM AND NOISE
100dB below rated output
90dB IHF

Ratings

IHF DYNAMIC HEADROOM
2.1dB at 4 ohm load
1.7dB at 8 ohm load

DAMPING FACTOR
Greater than 100

INPUT IMPEDANCE
20,000 ohms

INPUT SENSITIVITY
Switchable for either 1.4 volt or 2.5 volt

POWER REQUIREMENT
120 volts, 50/60Hz, 0.6 to 15 amperes

Outside Views

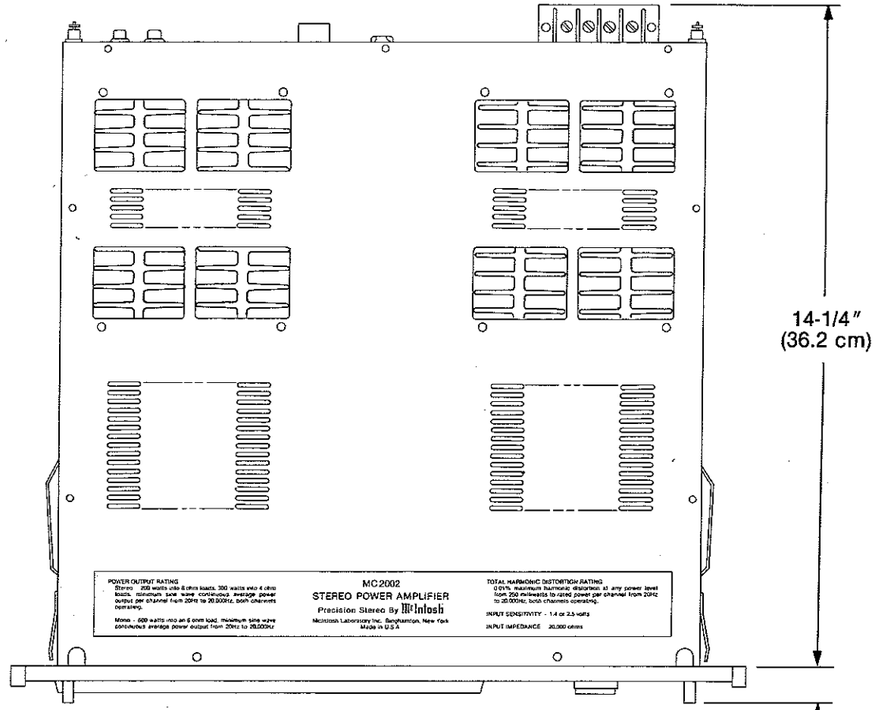


Fig. 1. Top View

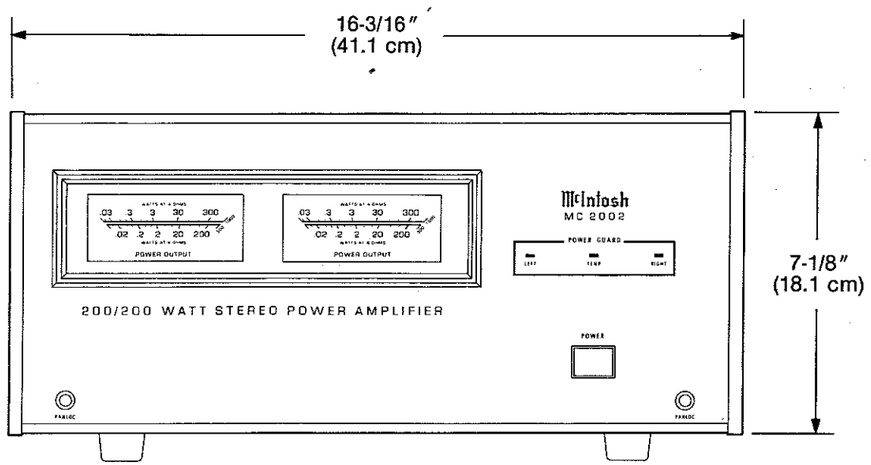


Fig. 2. Front View

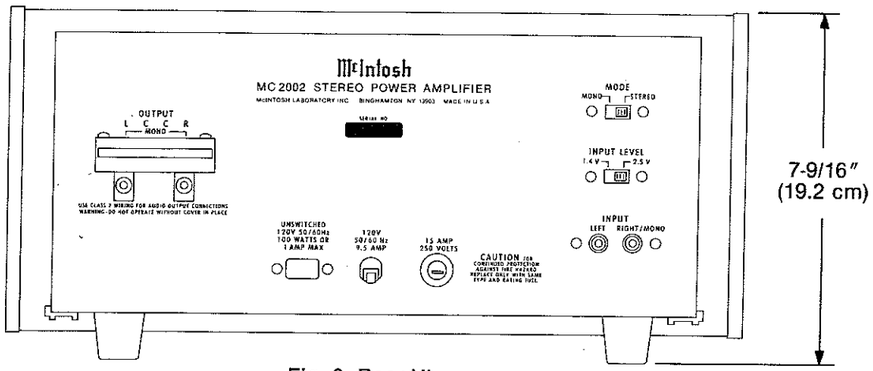


Fig. 3. Rear View

General Notes

1. Unless otherwise noted, all voltages indicated on the following schematics are measured under the following conditions:
   a. AC input at 120 volts, 50/60Hz.
   b. All voltages are ± 10% with respect to ground. A high impedance (10 megohm) voltmeter must be used.
   c. Front panel controls set at:
      POWER ..... ON
   d. Rear panel controls set at:
      MODE ..... STEREO
      INPUT LEVEL 2.5V
   e. The voltages enclosed in a box (Sections 2 through 4) are signal voltages that are measured with a 2.5V, 1kHz signal connected to both channels of the INPUT jacks.
2. The heavy lines on the schematics denote the primary signal paths.
3. Unless otherwise specified:
   a. Resistor values are in ohms.
   b. Capacitor values smaller than 1 are microfarads (μF), and capacitor values greater than 1 are in picofarads (pF).
   c. Inductor values are in microhenries (μH).
4. Symbols used in this manual are in conformance with the book "Electrical and Electronics Graphic Symbols and Reference Designations" published by the IEEE. Some important symbols are described below:

Plug disconnect (pin 2)

Solder connection (pin 2)

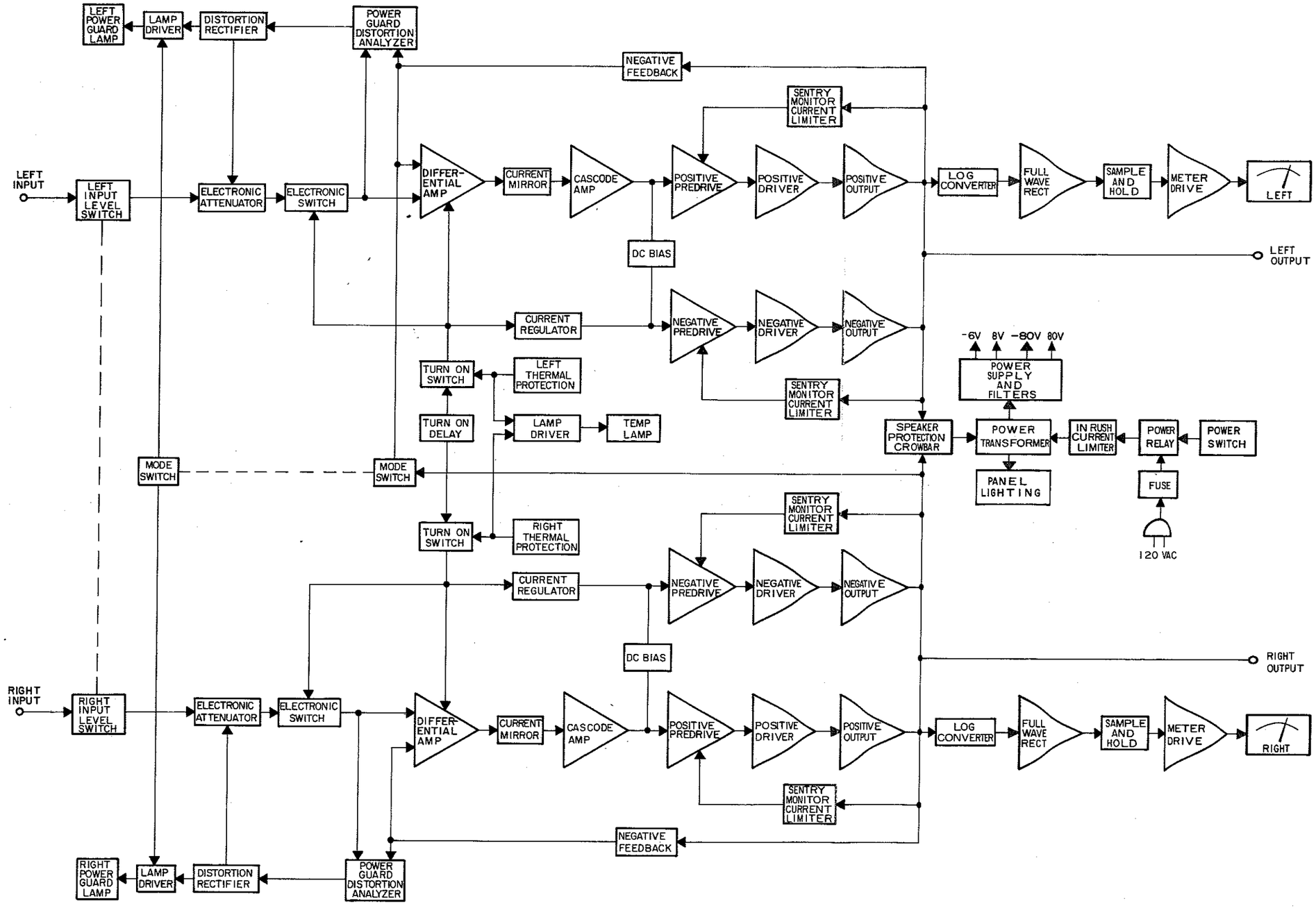
Section number reference. Wire connects to pin 18 of Section 4.

PC board ground

PC board ground (isolated connection)

Chassis ground

Block Diagram



Section Loca

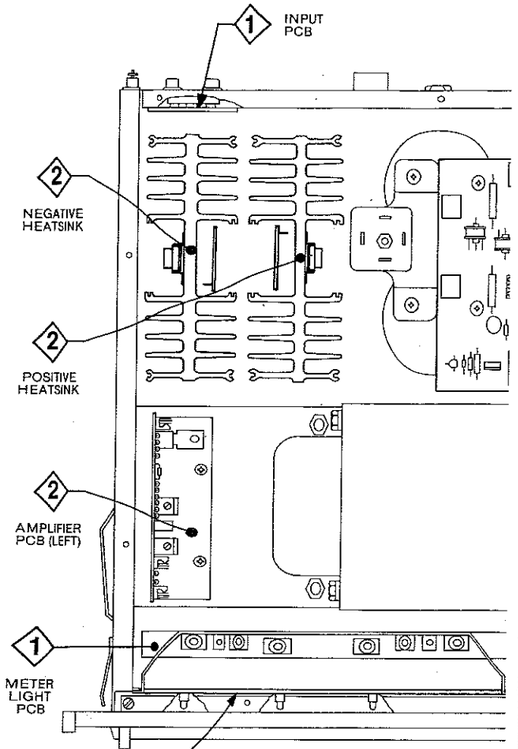


Fig. 4. Top view of unit w removed.

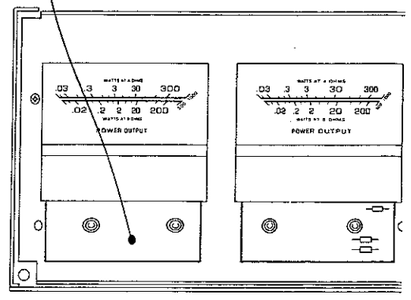
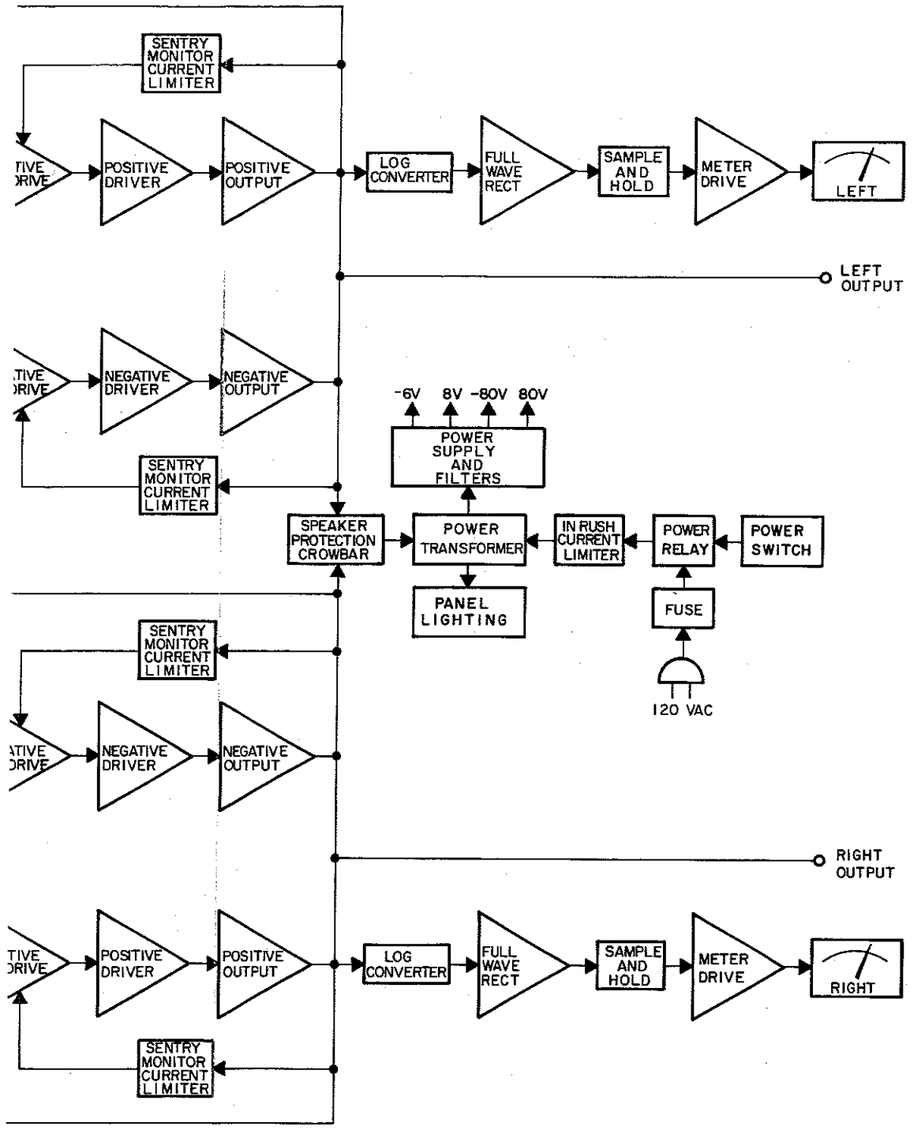


Fig. 5. Front view of unit v panel removed.

gram



Section Locations

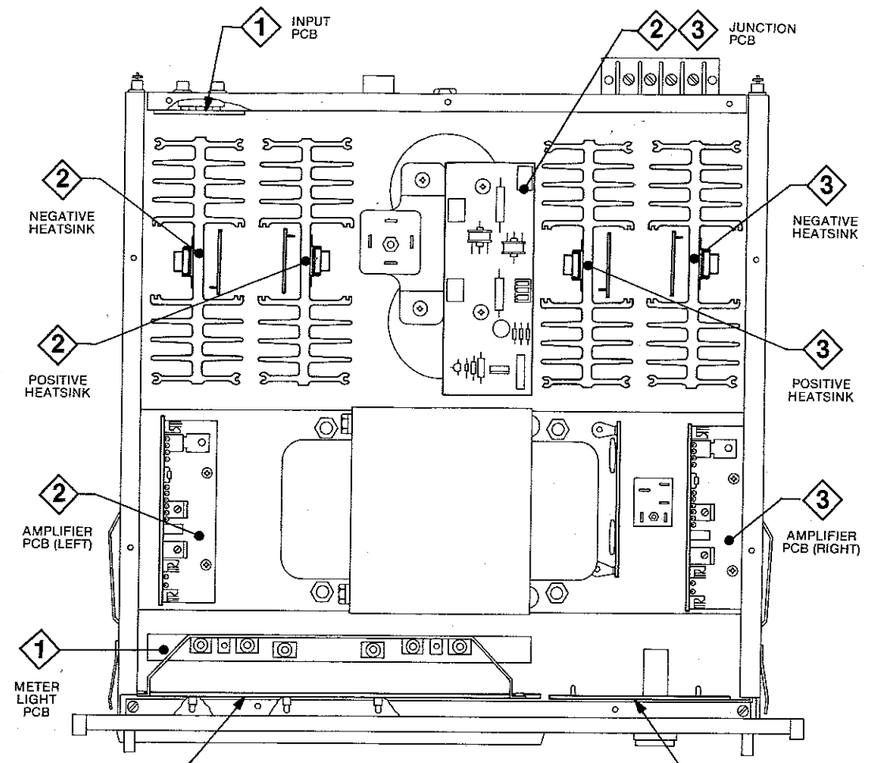


Fig. 4. Top view of unit with cover removed.

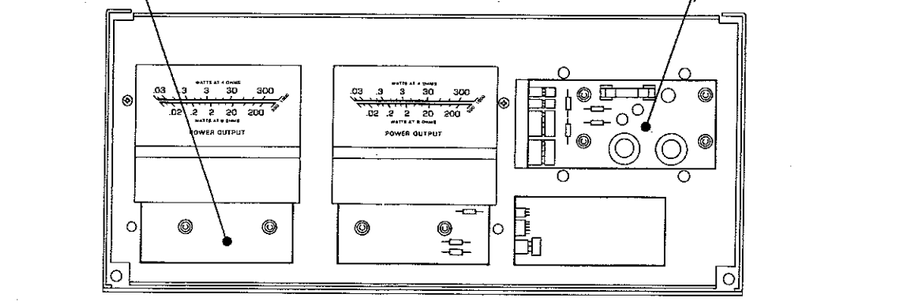


Fig. 5. Front view of unit with front panel removed.

Disassembly Instructions

TOP COVER. Remove the screws and lift off top. Make sure in reassembly that the 8 longer screws thread into the heatsinks.

BOTTOM COVER. Does not need to be removed for any section disassembly.

FRONT PANEL. Remove 2 screws from both the bottom and top covers. Remove 3 screws from each side and pull the front panel straight out, disconnecting 2 wire plugs.

SECTION 1
INPUT PC Board. Remove the top cover. Remove the heatsink blocking access to the PC board (see Section 2 & 3, Heatsink removal below). Remove 6 screws holding the PC board to the rear panel, then lift out, disconnecting 2 wire plugs and unsoldering 1 wire.

METER LIGHT PC Board. Remove the top cover and front panel. Remove 2 screws that hold the meter reflector to the subpanel. Remove 2 screws that hold the PC board to the reflector. Disconnect 1 wire plug.

PANEL LIGHT PC Board. Remove the front panel. Disconnect 2 remaining wire plugs from the PC board. Push against the PC board near the white snap-fasteners to unfasten, then lift out through the unit top.

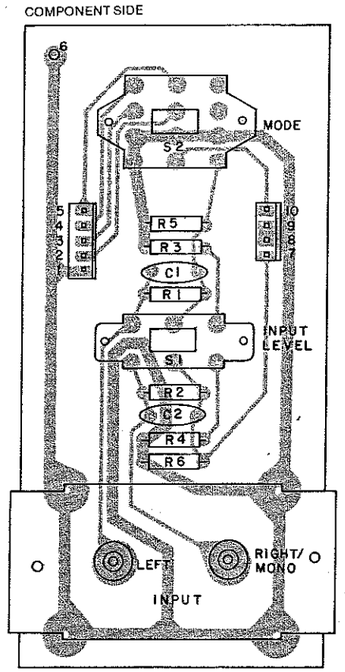
SECTIONS 2 and 3
AMPLIFIER PC Board (LEFT OR RIGHT). Remove the top cover. *Use a resistor to discharge the main storage capacitors C3 and C4 to chassis ground.* Remove 2 screws holding the PC board bracket to the bottom. Disconnect 6 wire plugs and lift out.

HEATSINKS (ALL). Remove the top cover. Remove 2 screws holding the heatsink to the bottom cover. Disconnect 1 wire plug from both the junction and amplifier PC boards, then lift out heatsink assembly.

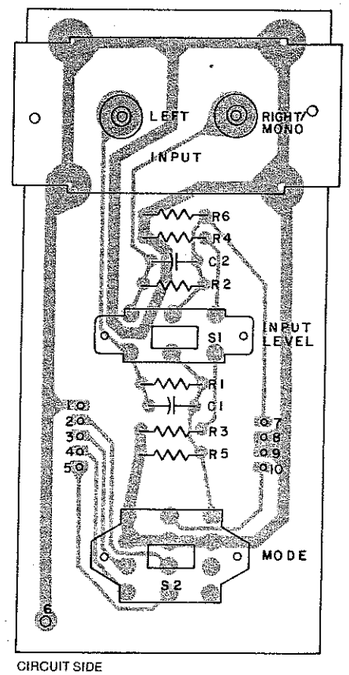
JUNCTION PC Board. Remove the top cover. Disconnect 4 wire plugs and unsolder 7 wires. Remove 2 screws holding the PC board to the main storage capacitors, then lift out.

SECTION 4
POWER SUPPLY/DISPLAY PC Board. Remove the top cover and the front panel. Disconnect 4 wire plugs and unsolder 3 wires. Push against the PC board near the white snap-fasteners to unfasten, then lift out.

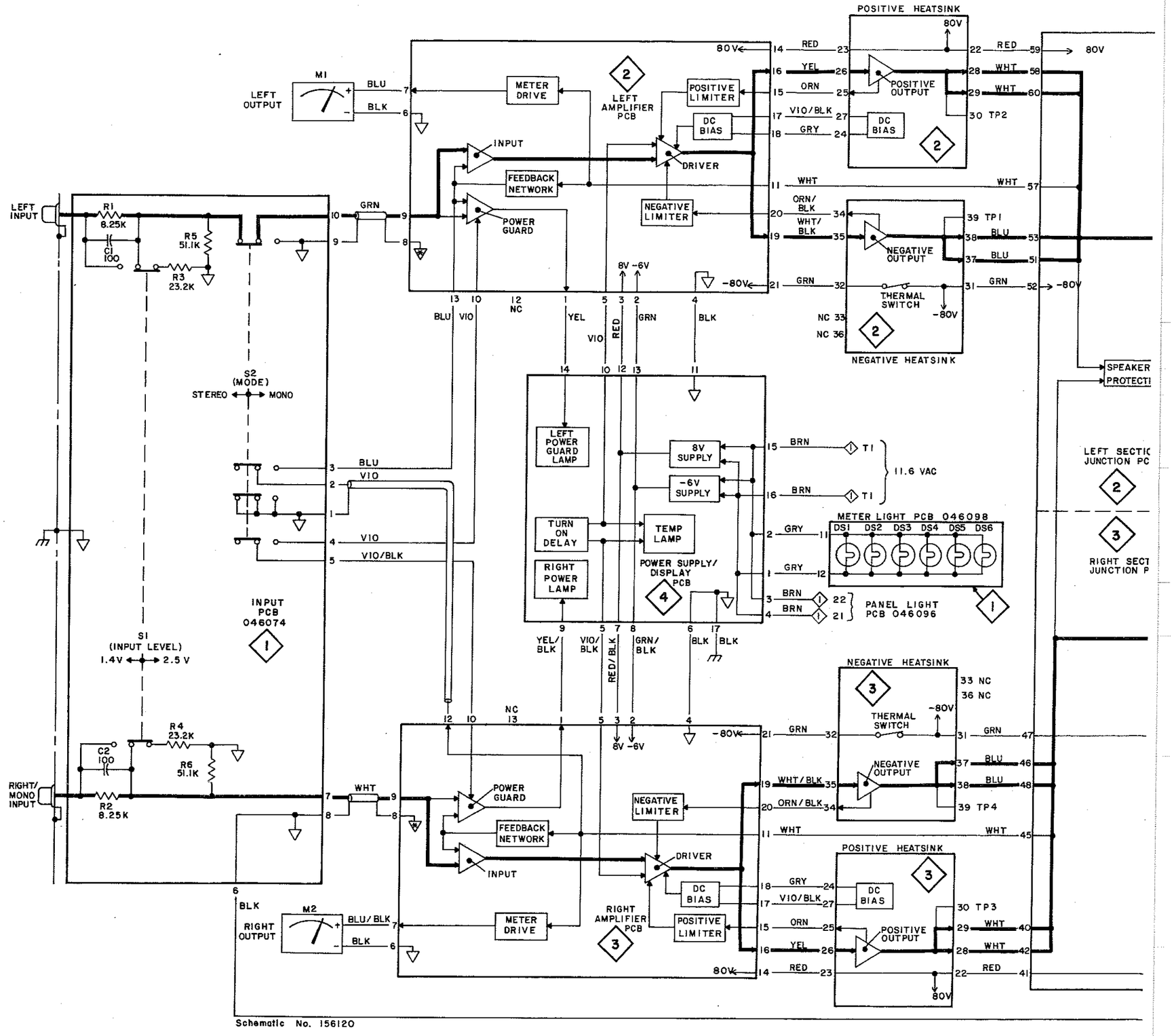
1 Interconnection Diagram

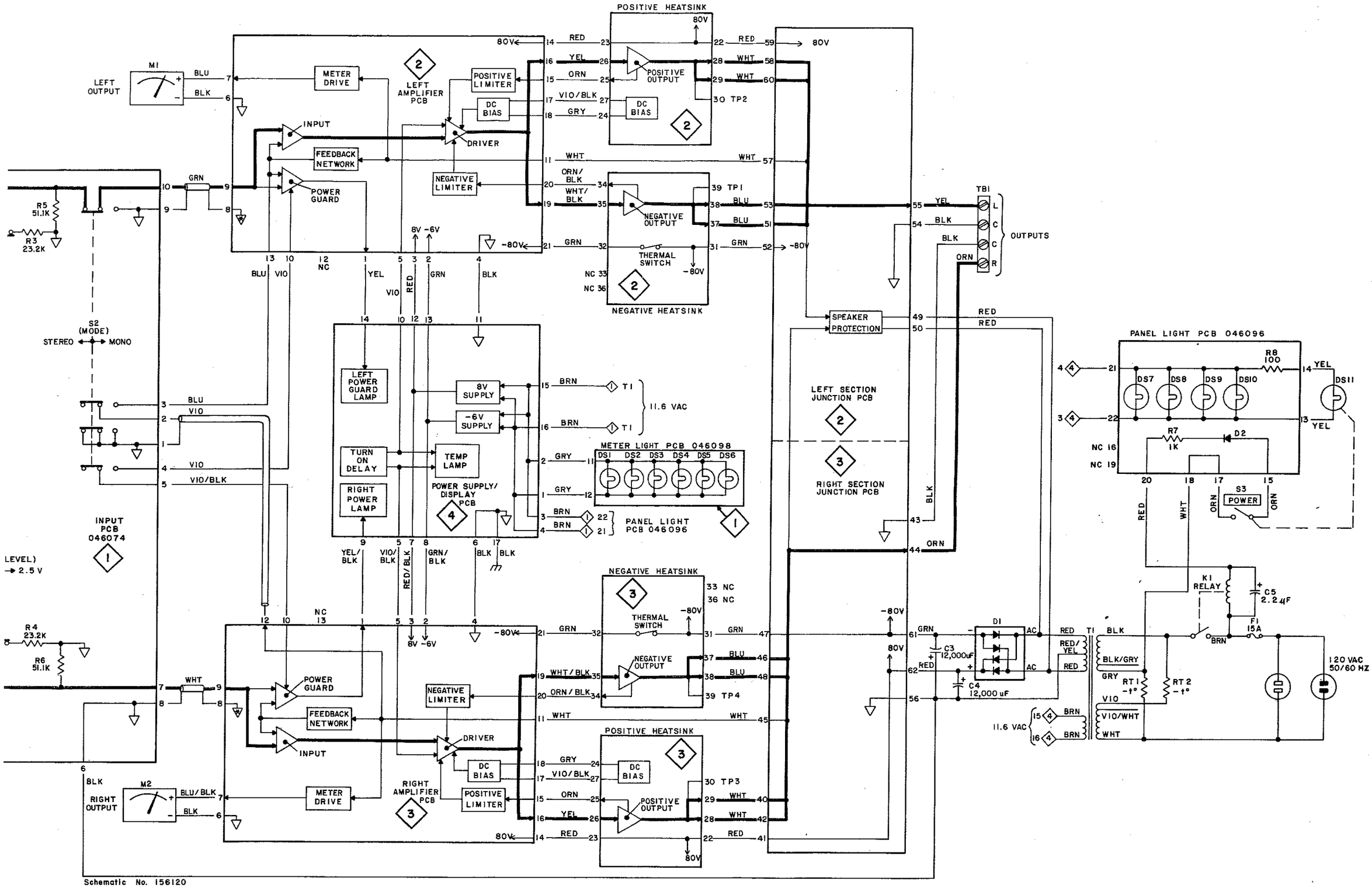


INPUT PC BOARD 046074



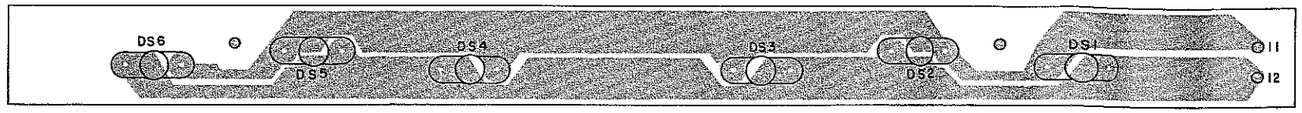
CIRCUIT SIDE





Schematic No. 156120

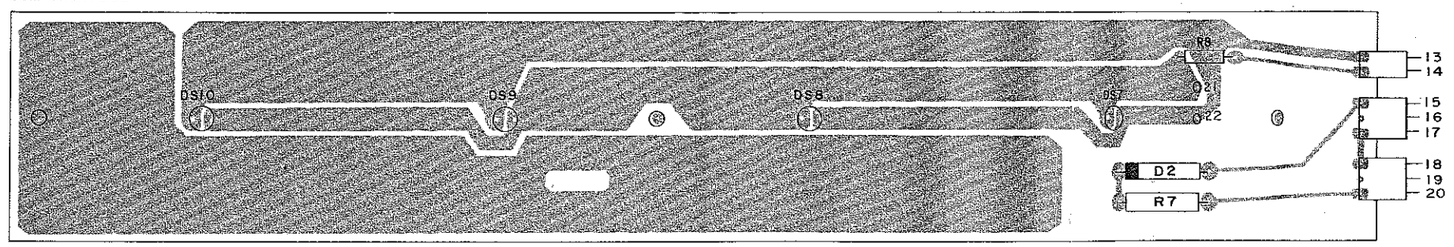
COMPONENT SIDE



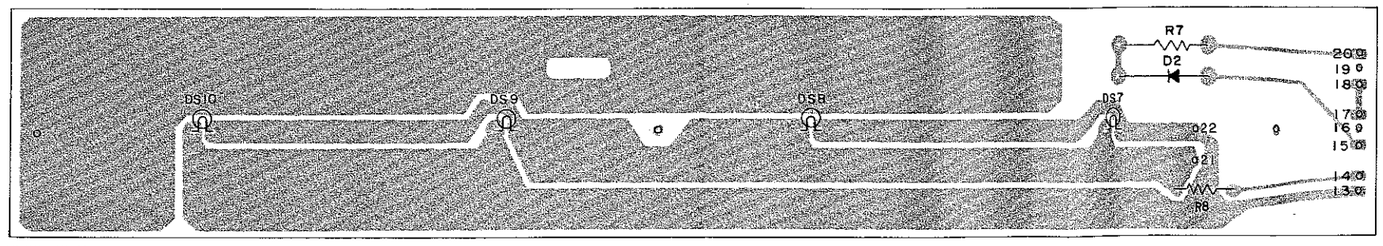
METER LIGHT PC BOARD 046098

CIRCUIT SIDE

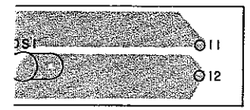
COMPONENT SIDE

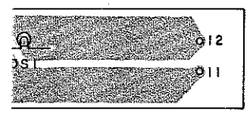


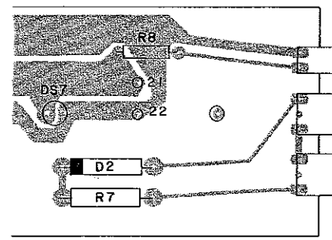
PANEL LIGHT PC BOARD 046096

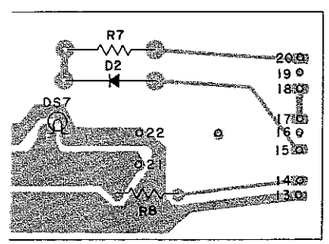


CIRCUIT SIDE









INTERCONNECTION DIAGRAM PARTS LIST

Symbol No.	Part No.	Description
CAPACITORS (ELECT = Electrolytic, CD = Ceramic Disc)		
*C1	061023	CD, 100pF, 10%, 500V, N1500
*C2	061023	CD, 100pF, 10%, 500V, N1500
*C3	066359	ELECT, 12,000μF, 100V
*C4	066359	ELECT, 12,000μF, 100V
C5	066357	ELECT, 2.2μF, 20%, 160V
DIODES (BRID = Bridge, RECT = Rectifier)		
*D1	070123	BRID, RECT, 35A, 400V, MDA3504
*D2	070031	RECT, 400V, 1.5A
LIGHTING DEVICES (INC = Incandescent)		
*DS1	058090	INC, 14V, 161
*DS2	058090	INC, 14V, 161
*DS3	058090	INC, 14V, 161
*DS4	058090	INC, 14V, 161
*DS5	058090	INC, 14V, 161
*DS6	058090	INC, 14V, 161
*DS7	058061	INC, 14V, 7382
*DS8	058061	INC, 14V, 7382
*DS9	058061	INC, 14V, 7382
*DS10	058061	INC, 14V, 7382
*DS11	058089	INC, 14V, 65mA
FUSES and FUSEHOLDERS (FA = Fast Acting)		
*F1	089042	Fuse, FA, 15A, 250V, ABC15
*	178122	Fuseholder
RELAYS		
*K1	087035	Relay, SPDT, 110VDC
METERS		
*M1	046161	Meter
*M2	046161	Meter
RESISTORS (MF = Metal Film, POT = Potentiometer, CF = Carbon Film)		
*R1	144153	MF, 8.25kΩ, 1%, 1/4W
*R2	144153	MF, 8.25kΩ, 1%, 1/4W
*R3	144147	MF, 23.2kΩ, 1%, 1/4W
*R4	144177	MF, 23.2kΩ, 1%, 1/4W
*R5	144155	MF, 51.1kΩ, 1%, 1/4W
*R6	144155	MF, 51.1kΩ, 1%, 1/4W
R7	141180	CF, 1kΩ, 5%, 1/2W
R8	141025	CF, 100Ω, 5%, 1/4W
THERMISTORS		
*RT1	144151	Thermistor, 5Ω
*RT2	144151	Thermistor, 5Ω
SWITCHES		
*S1	148049	Input Level Switch
*S2	148048	Mode Switch
*S3	046099	Power Switch, Pushbutton (Lens Cap only-017330)
TRANSFORMERS		
*T1	159171	Power
MISCELLANEOUS		
*TB1	074068	Terminal Block, 4 Pos.
	*017318	Terminal Block Cover
	084038	Strain Relief (Line Cord)
	117008	AC Receptacle, Red
	170133	Line Cord, 16 ga.

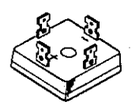
* Parts marked with an asterisk (*) are replacement parts stocked by our Service Department and must be ordered by part number. Parts not marked may be obtained from electronic parts suppliers.

INSTALLATION HARDWARE PARTS LIST

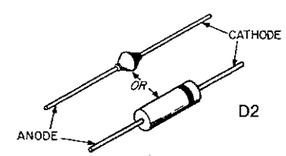
Part No.	Description
*017218	Plastic Foot, secure w/101072 screws
*038244	Mounting Template
*043677	Mounting Strips
*046208	S/N DG1001 to DG1524: Panloc Shelf Bracket, Right....(7854)
*043678	S/N DG1525 and above: Panloc Shelf Bracket, Right
*046209	S/N DG1001 to DG1524: Panloc Shelf Bracket, Left....(7854)
*043679	S/N DG1525 and above: Panloc Shelf Bracket, Left
*044871	Hardware Package
*101072	Sheetmetal Screw, #8 x ¾, Phillips, black

FRONT PANEL & TRIM PARTS LIST

Part No.	Description
*046063	Front Panel, Glass
*046091	Front Panel, Complete
*018155	Top Panel Rail, Secure w/100007 Screws
*018155	Bottom Panel Rail, Secure w/100103 Screws
*018173	End Cap, Secure w/101042 Screws
*100007	Machine Screw, 6-32 x ¼
*100103	Machine Screw, 6-32 x ⅛
*101042	Tapping Screw, 4-40 x ½, Fillister Head

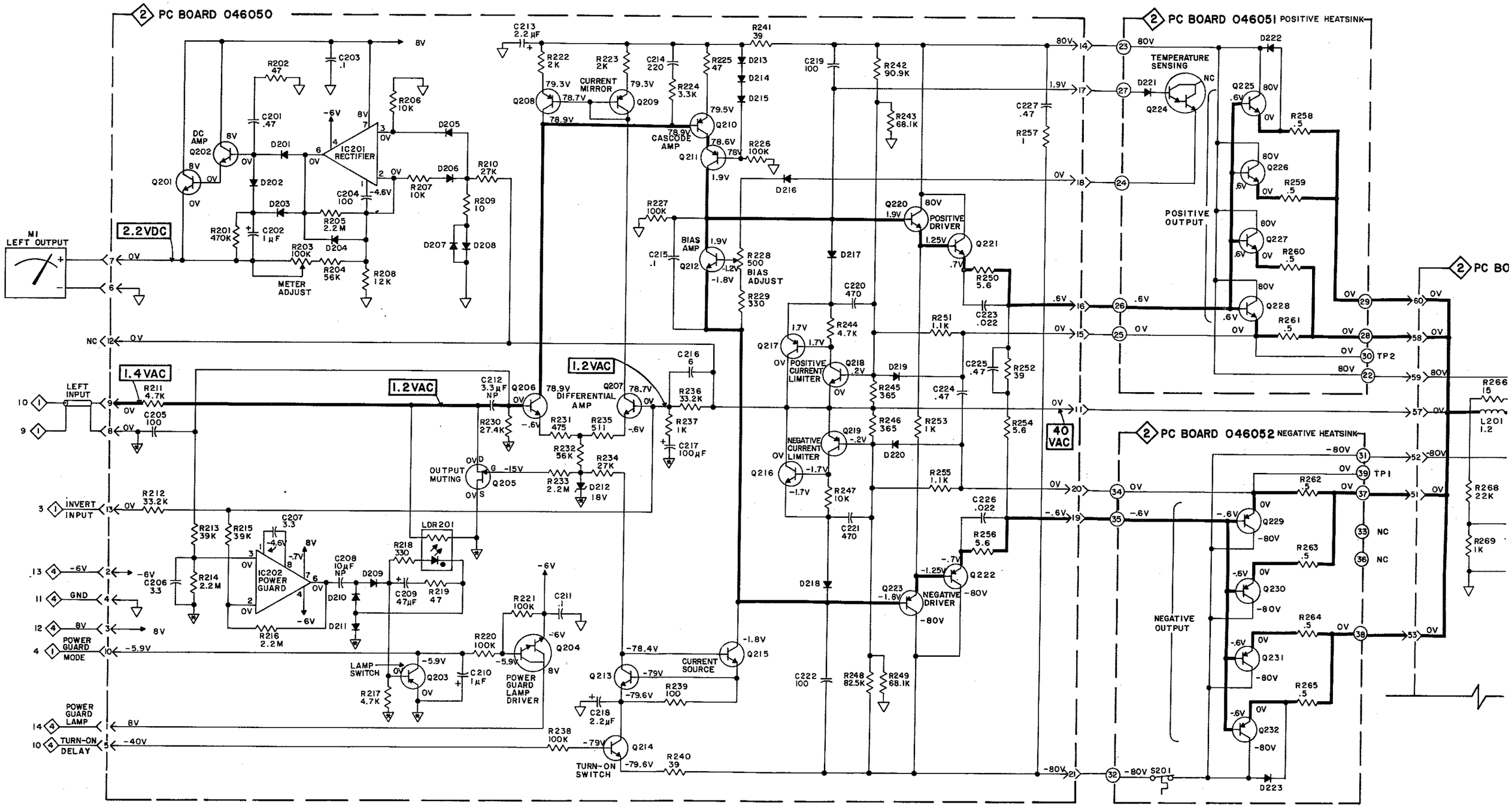


D1

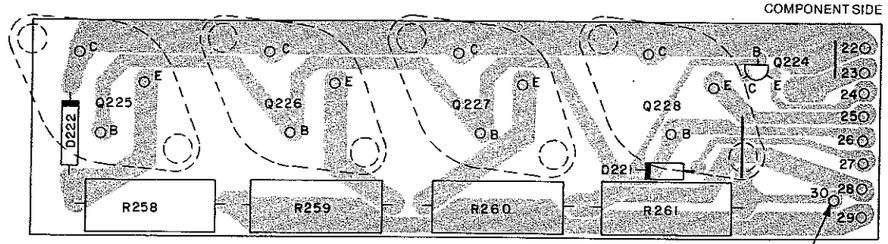


D2

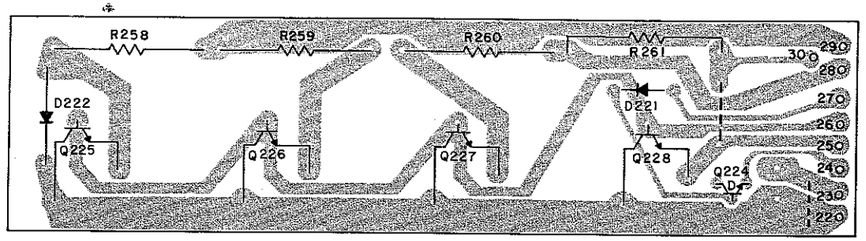
2 Amplifier (Left Channel)



COMPONENT SIDE



POSITIVE HEATSINK ASSEMBLY PC BOARD 046051

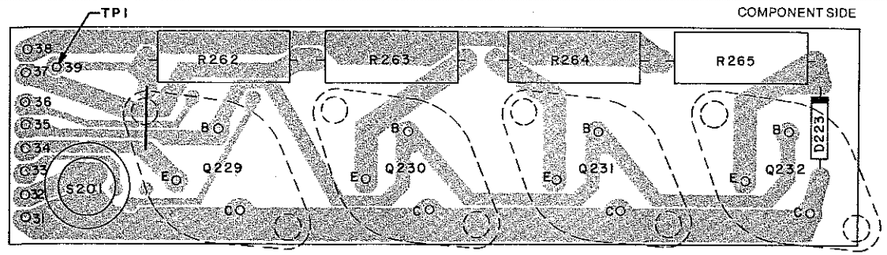


CIRCUIT SIDE

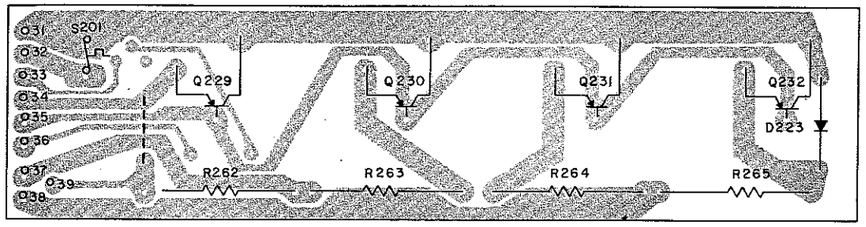
2 PC BOARD 046051 POSITIVE HEATSINK

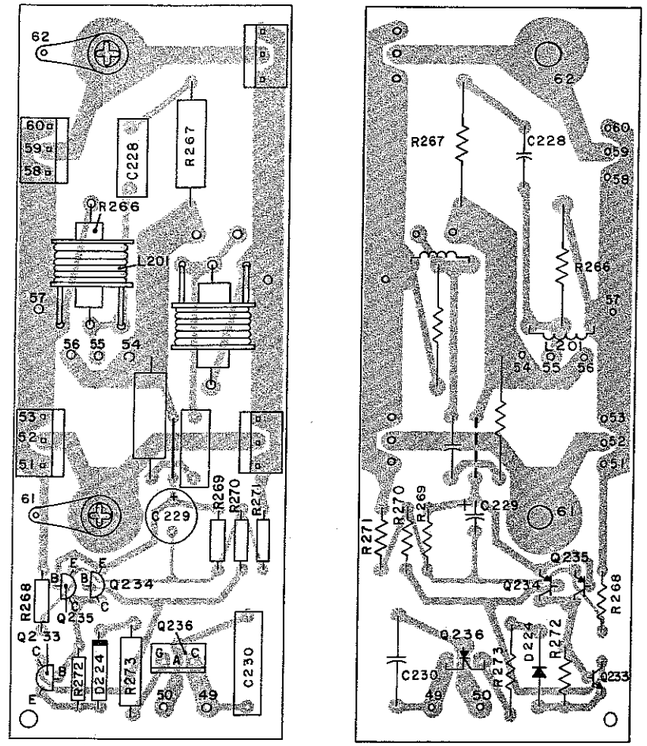
2 PC BOARD 046053

2 PC BOARD 046052 NEGATIVE HEATSINK

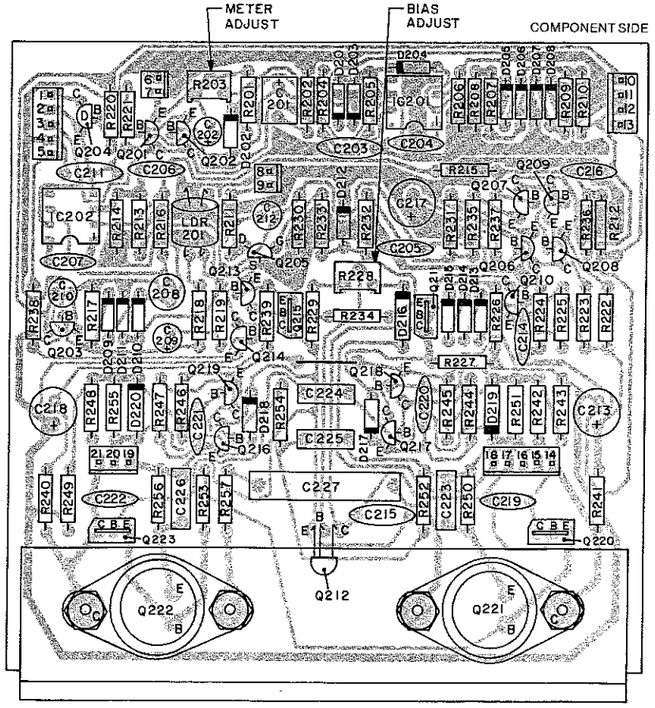


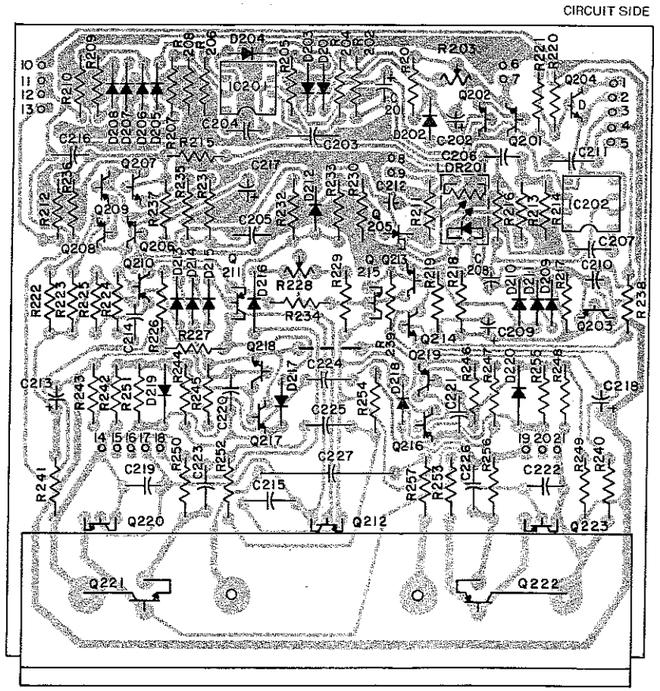
NEGATIVE HEATSINK ASSEMBLY PC BOARD 046052





JUNCTION PC BOARD 046053

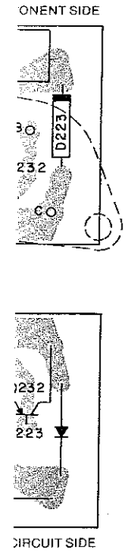


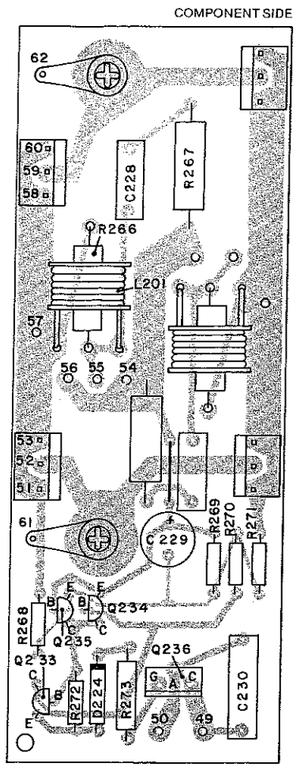


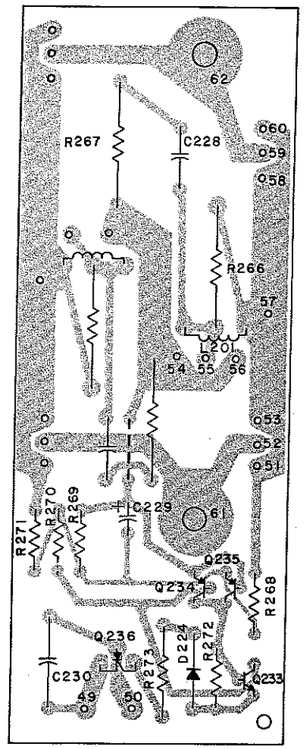
AMPLIFIER (RIGHT CHANNEL) PC BOARD 046050

AMPLIFIER (LEFT CHANNEL) PARTS LIST

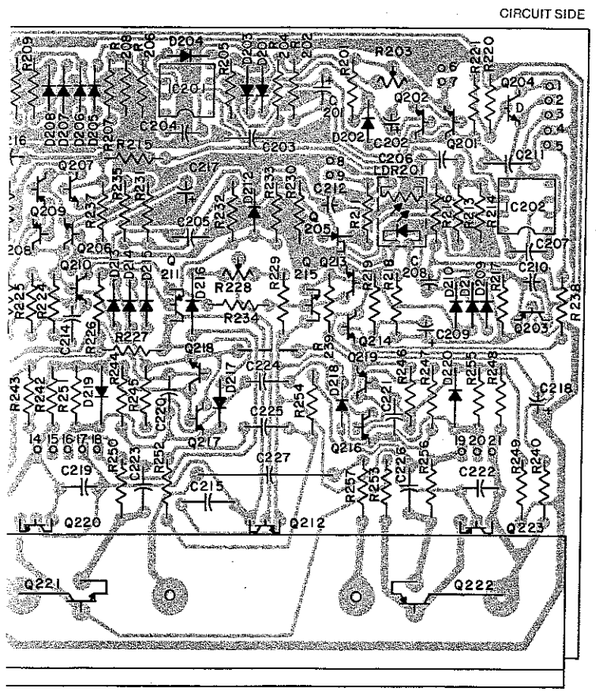
Symbol No.	Part No.	Description
CAPACITORS (MPE = Metalized Polyester, CD = Ceramic Disc, ELECT = Electrolytic)		
C201	064333	MPE, .47μF, 5%, 50V
*C202	066269	ELECT, 1μF, 50V
C203	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
C204	061023	CD, 100pF, 10%, 500V, N1500
C205	061023	CD, 100pF, 10%, 500V, N1500
C206	061087	CD, 3.3pF, 10%, 500V, NPO
C207	061087	CD, 3.3pF, 10%, 500V, NPO
*C208	066316	ELECT, 10μF, 25V, NP
C209	066215	ELECT, 47μF, 16V
*C210	066269	ELECT, 1μF, 50V
C211	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
*C212	066277	ELECT, 3.3μF, 20%, 50V, NP
C213	066357	ELECT, 2.2μF, 20%, 160V
C214	061027	CD, 220pF, 10%, 500V, Z5F
C215	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
*C216	061142	CD, 6pF, 5%, 500V, N470
C217	066226	ELECT, 100μF, 16V
C218	066357	ELECT, 2.2μF, 20%, 160V
C219	061023	CD, 100pF, 10%, 500V, N1500
C220	061128	CD, 470pF, 10%, 500V, Z5F
C221	061128	CD, 470pF, 10%, 500V, Z5F
C222	061023	CD, 100pF, 10%, 500V, N1500
C223	064246	MPE, .022μF, 10%, 63V
C224	064262	MPE, .47μF, 10%, 63V
C225	064262	MPE, .47μF, 10%, 63V
C226	064246	MPE, .022μF, 10%, 63V
C227	064340	MPE, .47μF, 10%, 250V
C228	064341	MPE, .033μF, 10%, 400V
C229	066327	ELECT, 470μF, 10V
C230	064339	MPE, .15μF, 10%, 400V
DIODES (SIG = Signal, ZN = Zener, RECT = Rectifier, STAB = Stabistor, GE = Germanium)		
*D201	070047	SIG, 75V, 10mA, IN4148
*D202	070047	SIG, 75V, 10mA, IN4148
*D203	070047	SIG, 75V, 10mA, IN4148
*D204	070047	SIG, 75V, 10mA, IN4148
*D205	070047	SIG, 75V, 10mA, IN4148
*D206	070047	SIG, 75V, 10mA, IN4148
*D207	070047	SIG, 75V, 10mA, IN4148
*D208	070047	SIG, 75V, 10mA, IN4148
*D209	070047	SIG, 75V, 10mA, IN4148
*D210	070047	SIG, 75V, 10mA, IN4148
*D211	070047	SIG, 75V, 10mA, IN4148
*D212	070103	ZN, 18V, 5%, 500mW, IN5248B
*D213	070047	SIG, 75V, 10mA, IN4148
*D214	070047	SIG, 75V, 10mA, IN4148
*D215	070047	SIG, 75V, 10mA, IN4148
*D216	070046	STAB, 1.3V, 2%, 10mA, Selected MZ2361
*D217	070047	SIG, 75V, 10mA, IN4148
*D218	070047	SIG, 75V, 10mA, IN4148
*D219	070003	GE, SIG, 45V, 10mA, IN542
*D220	070003	GE, SIG, 45V, 10mA, IN542
*D221	070047	SIG, 75V, 10mA, IN4148
*D222	070031	RECT, 400 PIV, 1.5A
*D223	070031	RECT, 400 PIV, 1.5A
*D224	070031	RECT, 400 PIV, 1.5A
INTEGRATED CIRCUITS		
*IC201	133068	Operational Amp LM201AN
*IC202	133068	Operational Amp LM201AN
COILS		
*L201	122228	Choke, 1.2μH
LIGHT DEPENDENT RESISTORS		
*LDR201	144179	LDR, VTL5C9
TRANSISTORS (N = N Channel, JFET = Junction FET, DAR = Darlington, SCR = Silicon Controlled Rectifier)		
*Q201	132195	NPN, Selected 2N6428A
*Q202	132195	NPN, Selected 2N6428A
*Q203	132172	PNP, MPS-A55
*Q204	132090	NPN, DAR, Selected MPS-A14
*Q205	132193	N, JFET, 2N4392
*Q206	132215	NPN, 2N5551
*Q207	132215	NPN, 2N5551
*Q208	132056	PNP, 2N5087
*Q209	132056	PNP, 2N5087
*Q210	132056	PNP, 2N5087
*Q211	132211	PNP, MDS60
*Q212	132171	NPN, MPS-A05
*Q213	132171	NPN, MPS-A05
*Q214	132136	NPN, MPS-A42
*Q215	132210	NPN, MDS21
*Q216	132171	NPN, MPS-A05
*Q217	132172	PNP, MPS-A55
*Q218	132171	NPN, MPS-A05
*Q219	132172	PNP, MPS-A55
*Q220	132210	NPN, MDS21
*Q221	132217	NPN
*Q222	132216	PNP
*Q223	132211	PNP, MDS60
*Q224	132090	NPN, DAR, Selec
*Q225	132212	NPN
*Q226	132212	NPN
*Q227	132212	NPN
*Q228	132212	NPN
*Q229	132213	PNP
*Q230	132213	PNP
*Q231	132213	PNP
*Q232	132213	PNP
*Q233	132136	NPN, MPS-A42
*Q234	132147	PNP, MPS-A93
*Q235	132147	PNP, MPS-A93
*Q236	131014	SCR, MCR264-6
RESISTORS (CF = Carbon Film, POT = F MF = Metal Film, FP = Flam WW = Wirewound)		
R201	141112	CF, 470kΩ, 5%,
R202	141152	CF, 47Ω, 5%, 1/
*R203	134383	POT, 100kΩ
R204	141090	CF, 56kΩ, 5%, 1
R205	141124	CF, 2.2MΩ, 5%,
R206	141072	CF, 10kΩ, 5%, 1
R207	141072	CF, 10kΩ, 5%, 1
R208	141074	CF, 12kΩ, 5%, 1
R209	141136	CF, 10Ω, 5%, 1/
R210	141082	CF, 27kΩ, 5%, 1
R211	141064	CF, 4.7kΩ, 5%,
*R212	144106	MF, 33.2kΩ, 1%
R213	141086	CF, 39kΩ, 5%, 1
R214	141124	CF, 2.2MΩ, 5%,
R215	141086	CF, 39kΩ, 5%, 1
R216	141124	CF, 2.2MΩ, 5%,
R217	141064	CF, 4.7kΩ, 5%,
R218	141037	CF, 330Ω, 5%, 1
R219	141152	CF, 47Ω, 5%, 1/
R220	141096	CF, 100kΩ, 5%,
R221	141096	CF, 100kΩ, 5%,
*R222	144094	MF, 2kΩ, 1%, 1/
*R223	144094	MF, 2kΩ 1%, 1/
*R224	141060	CF, 3.3kΩ, 5%,
*R225	141152	CF, 47Ω, 5%, 1/
R226	141096	CF, 100kΩ, 5%,
R227	141096	CF, 100kΩ, 5%,
*R228	134410	POT, 500Ω, 20%,
R229	141037	CF, 330Ω, 5%, 1
*R230	144141	MF, 27.4kΩ, 1%
*R231	144086	MF, 475Ω, 1%, 1
R232	141090	CF, 56kΩ, 5%, 1
R233	141124	CF, 2.2MΩ, 5%,
R234	141082	CF, 27kΩ, 5%, 1
*R235	144123	MF, 511Ω,, 2%,
*R236	144106	MF, 33.2kΩ, 1%,
*R237	144090	MF, 1kΩ, 1%, 1/
R238	141096	CF, 100kΩ, 5%,
*R239	144163	FP, 100Ω, 5%, 1.
*R240	144169	FP, 39Ω, 5%, 1/
*R241	144169	FP, 39Ω, 5%, 1/
*R242	144170	MF, 90.9kΩ, 1%,
*R243	144081	MF, 68.1kΩ, 1%,
R244	141064	CF, 4.7kΩ, 5%,
*R245	144071	MF, 365Ω, 1%, 1
*R246	144071	MF, 365Ω, 1%, 1
R247	141072	CF, 10kΩ, 5%, 1.
*R248	144112	MF, 82.5kΩ, 1%,
*R249	144081	MF, 68.1kΩ, 1%,
*R250	144168	FP, 5.6Ω, 5%, 1/







JUNCTION PC BOARD 046053

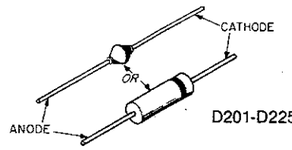


BOARD 046050

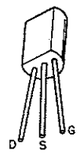
AMPLIFIER (LEFT CHANNEL) PARTS LIST

Symbol No.	Part No.	Description
CAPACITORS (MPE = Metalized Polyester, CD = Ceramic Disc, ELECT = Electrolytic)		
C201	064333	MPE, .47μF, 5%, 50V
*C202	066269	ELECT, 1μF, 50V
C203	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
C204	061023	CD, 100pF, 10%, 500V, N1500
C205	061023	CD, 100pF, 10%, 500V, N1500
C206	061087	CD, 3.3pF, 10%, 500V, NPO
C207	061087	CD, 3.3pF, 10%, 500V, NPO
*C208	066316	ELECT, 10μF, 25V, NP
C209	066215	ELECT, 47μF, 16V
*C210	066269	ELECT, 1μF, 50V
C211	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
*C212	066277	ELECT, 3.3μF, 20%, 50V, NP
C213	066357	ELECT, 2.2μF, 20%, 160V
C214	061027	CD, 220pF, 10%, 500V, Z5F
C215	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
*C216	061142	CD, 6pF, 5%, 500V, N470
C217	066226	ELECT, 100μF, 16V
C218	066357	ELECT, 2.2μF, 20%, 160V
C219	061023	CD, 100pF, 10%, 500V, N1500
C220	061128	CD, 470pF, 10%, 500V, Z5F
C221	061128	CD, 470pF, 10%, 500V, Z5F
C222	061023	CD, 100pF, 10%, 500V, N1500
C223	064246	MPE, .022μF, 10%, 63V
C224	064262	MPE, .47μF, 10%, 63V
C225	064262	MPE, .47μF, 10%, 63V
C226	064246	MPE, .022μF, 10%, 63V
C227	064340	MPE, .47μF, 10%, 250V
C228	064341	MPE, .033μF, 10%, 400V
C229	066327	ELECT, 470μF, 10V
C230	064339	MPE, .15μF, 10%, 400V
DIODES (SIG = Signal, ZN = Zener, RECT = Rectifier, STAB = Stabistor, GE = Germanium)		
*D201	070047	SIG, 75V, 10mA, IN4148
*D202	070047	SIG, 75V, 10mA, IN4148
*D203	070047	SIG, 75V, 10mA, IN4148
*D204	070047	SIG, 75V, 10mA, IN4148
*D205	070047	SIG, 75V, 10mA, IN4148
*D206	070047	SIG, 75V, 10mA, IN4148
*D207	070047	SIG, 75V, 10mA, IN4148
*D208	070047	SIG, 75V, 10mA, IN4148
*D209	070047	SIG, 75V, 10mA, IN4148
*D210	070047	SIG, 75V, 10mA, IN4148
*D211	070047	SIG, 75V, 10mA, IN4148
*D212	070103	ZN, 18V, 5%, 500mW, IN5248B
*D213	070047	SIG, 75V, 10mA, IN4148
*D214	070047	SIG, 75V, 10mA, IN4148
*D215	070047	SIG, 75V, 10mA, IN4148
*D216	070046	STAB, 1.3V, 2%, 10mA, Selected MZ2361
*D217	070047	SIG, 75V, 10mA, IN4148
*D218	070047	SIG, 75V, 10mA, IN4148
*D219	070003	GE, SIG, 45V, 10mA, IN542
*D220	070003	GE, SIG, 45V, 10mA, IN542
*D221	070047	SIG, 75V, 10mA, IN4148
*D222	070031	RECT, 400 PIV, 1.5A
*D223	070031	RECT, 400 PIV, 1.5A
*D224	070031	RECT, 400 PIV, 1.5A
INTEGRATED CIRCUITS		
*IC201	133068	Operational Amp LM201AN
*IC202	133068	Operational Amp LM201AN
COILS		
*L201	122228	Choke, 1.2μH
LIGHT DEPENDENT RESISTORS		
*LDR201	144179	LDR, VTL5C9
TRANSISTORS (N = N Channel, JFET = Junction FET, DAR = Darlington, SCR = Silicon Controlled Rectifier)		
*Q201	132195	NPN, Selected 2N6428A
*Q202	132195	NPN, Selected 2N6428A
*Q203	132172	PNP, MPS-A55
*Q204	132090	NPN, DAR, Selected MPS-A14
*Q205	132193	N, JFET, 2N4392
*Q206	132215	NPN, 2N5551
*Q207	132215	NPN, 2N5551
*Q208	132056	PNP, 2N5087
*Q209	132056	PNP, 2N5087
*Q210	132056	PNP, 2N5087
*Q211	132211	PNP, MDS60
*Q212	132171	NPN, MPS-A05
*Q213	132171	NPN, MPS-A05
*Q214	132136	NPN, MPS-A42
*Q215	132210	NPN, MDS21
*Q216	132171	NPN, MPS-A05
*Q217	132172	PNP, MPS-A55
*Q218	132171	NPN, MPS-A05
*Q219	132172	PNP, MPS-A55
*Q220	132210	NPN, MDS21
*Q221	132217	NPN
*Q222	132216	PNP
*Q223	132211	PNP, MDS60
*Q224	132090	NPN, DAR, Selected MPS-A14
*Q225	132212	NPN
*Q226	132212	NPN
*Q227	132212	NPN
*Q228	132212	NPN
*Q229	132213	PNP
*Q230	132213	PNP
*Q231	132213	PNP
*Q232	132213	PNP
*Q233	132136	NPN, MPS-A42
*Q234	132147	PNP, MPS-A93
*Q235	132147	PNP, MPS-A93
*Q236	131014	SCR, MCR264-6
RESISTORS (CF = Carbon Film, POT = Potentiometer, MF = Metal Film, FP = Flameproof, WW = Wirewound)		
R201	141112	CF, 470kΩ, 5%, 1/4W
R202	141152	CF, 47Ω, 5%, 1/4W
*R203	134383	POT, 100kΩ
R204	141090	CF, 56kΩ, 5%, 1/4W
R205	141124	CF, 2.2MΩ, 5%, 1/4W
R206	141072	CF, 10kΩ, 5%, 1/4W
R207	141072	CF, 10kΩ, 5%, 1/4W
R208	141074	CF, 12kΩ, 5%, 1/4W
R209	141136	CF, 10Ω, 5%, 1/4W
R210	141082	CF, 27kΩ, 5%, 1/4W
R211	141064	CF, 4.7kΩ, 5%, 1/4W
*R212	144106	MF, 33.2kΩ, 1%, 1/4W
R213	141086	CF, 39kΩ, 5%, 1/4W
R214	141124	CF, 2.2MΩ, 5%, 1/4W
R215	141086	CF, 39kΩ, 5%, 1/4W
R216	141124	CF, 2.2MΩ, 5%, 1/4W
R217	141064	CF, 4.7kΩ, 5%, 1/4W
R218	141037	CF, 330Ω, 5%, 1/4W
R219	141152	CF, 47Ω, 5%, 1/4W
R220	141096	CF, 100kΩ, 5%, 1/4W
R221	141096	CF, 100kΩ, 5%, 1/4W
*R222	144094	MF, 2kΩ, 1%, 1/4W
*R223	144094	MF, 2kΩ 1%, 1/4W
*R224	141060	CF, 3.3kΩ, 5%, 1/4W
*R225	141152	CF, 47Ω, 5%, 1/4W
R226	141096	CF, 100kΩ, 5%, 1/4W
R227	141096	CF, 100kΩ, 5%, 1/4W
*R228	134410	POT, 500Ω, 20%,
R229	141037	CF, 330Ω, 5%, 1/4W
*R230	144141	MF, 27.4kΩ, 1%, 1/4W
*R231	144086	MF, 475Ω, 1%, 1/4W
R232	141090	CF, 56kΩ, 5%, 1/4W
R233	141124	CF, 2.2MΩ, 5%, 1/4W
R234	141082	CF, 27kΩ, 5%, 1/4W
*R235	144123	MF, 511Ω,, 2%, 1/4W
*R236	144106	MF, 33.2kΩ, 1%, 1/4W
*R237	144090	MF, 1kΩ, 1%, 1/4W
R238	141096	CF, 100kΩ, 5%, 1/4W
*R239	144163	FP, 100Ω, 5%, 1/4W
*R240	144169	FP, 39Ω, 5%, 1/4W
*R241	144169	FP, 39Ω, 5%, 1/4W
*R242	144170	MF, 90.9kΩ, 1%, 1/4W
*R243	144081	MF, 68.1kΩ, 1%, 1/4W
R244	141064	CF, 4.7kΩ, 5%, 1/4W
*R245	144071	MF, 365Ω, 1%, 1/4W
*R246	144071	MF, 365Ω, 1%, 1/4W
R247	141072	CF, 10kΩ, 5%, 1/4W
*R248	144112	MF, 82.5kΩ, 1%, 1/4W
*R249	144081	MF, 68.1kΩ, 1%, 1/4W
*R250	144168	FP, 5.6Ω, 5%, 1/4W
*R251	144091	MF, 1.1kΩ, 1%, 1/4W
*R252	144169	FP, 39Ω, 5%, 1/4W
*R253	144090	MF, 1kΩ, 1%, 1/4W
*R254	144168	FP, 5.6Ω, 5%, 1/4W
*R255	144091	MF, 1.1kΩ, 1%, 1/4W
*R256	144168	FP, 5.6Ω, 5%, 1/4W
R257	141001	CF, 1Ω, 5%, 1/4W
*R258	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R259	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R260	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R261	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R262	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R263	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R264	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R265	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R266	139139	WW, 15Ω, 10%, 2W
*R267	139002	WW, 2.7Ω, 10%, 2W
R268	141080	CF, 22kΩ, 5%, 1/4W
R269	141049	CF, 1kΩ, 5%, 1/4W
R270	141072	CF, 10kΩ, 5%, 1/4W
R271	141080	CF, 22kΩ, 5%, 1/4W
R272	141059	CF, 2.7kΩ, 5%, 1/4W
*R273	139160	WW, 150Ω, 5%, 1W
SWITCHES		
*S201	153018	Thermal Switch
MISCELLANEOUS		
	*178118	TO-3 Socket

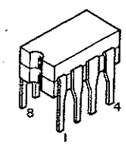
* Parts marked with an asterisk (*) are replacement parts stocked by our Service Department and must be ordered by part number. Parts not marked may be obtained from electronic parts suppliers.



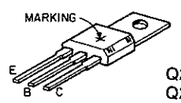
D201-D225



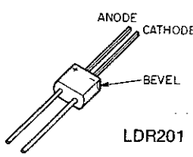
Q205



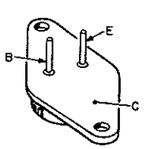
IC201, IC202



Q211, Q220, (

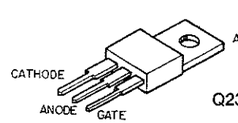


LDR201



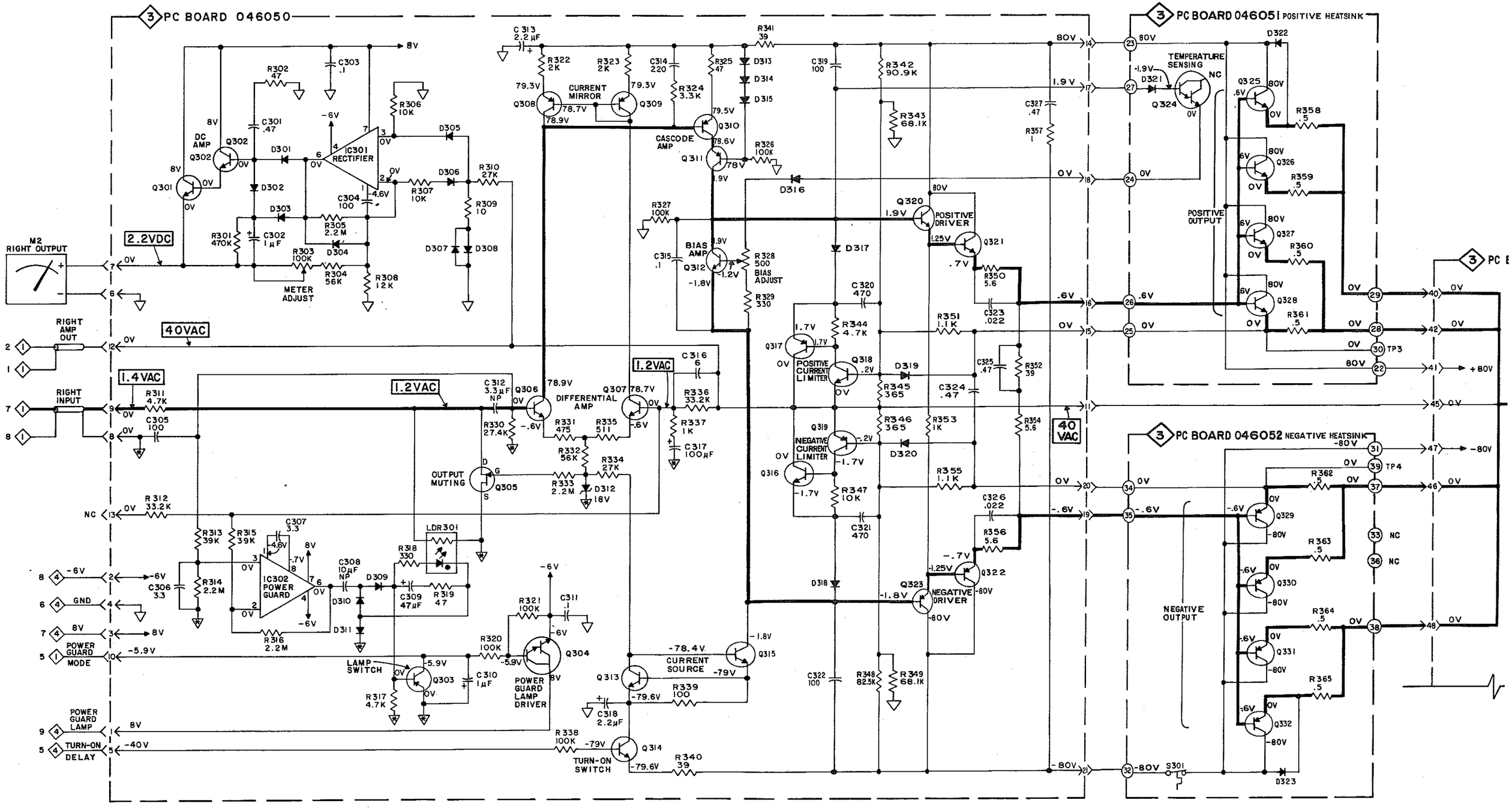
Q221, Q225-Q

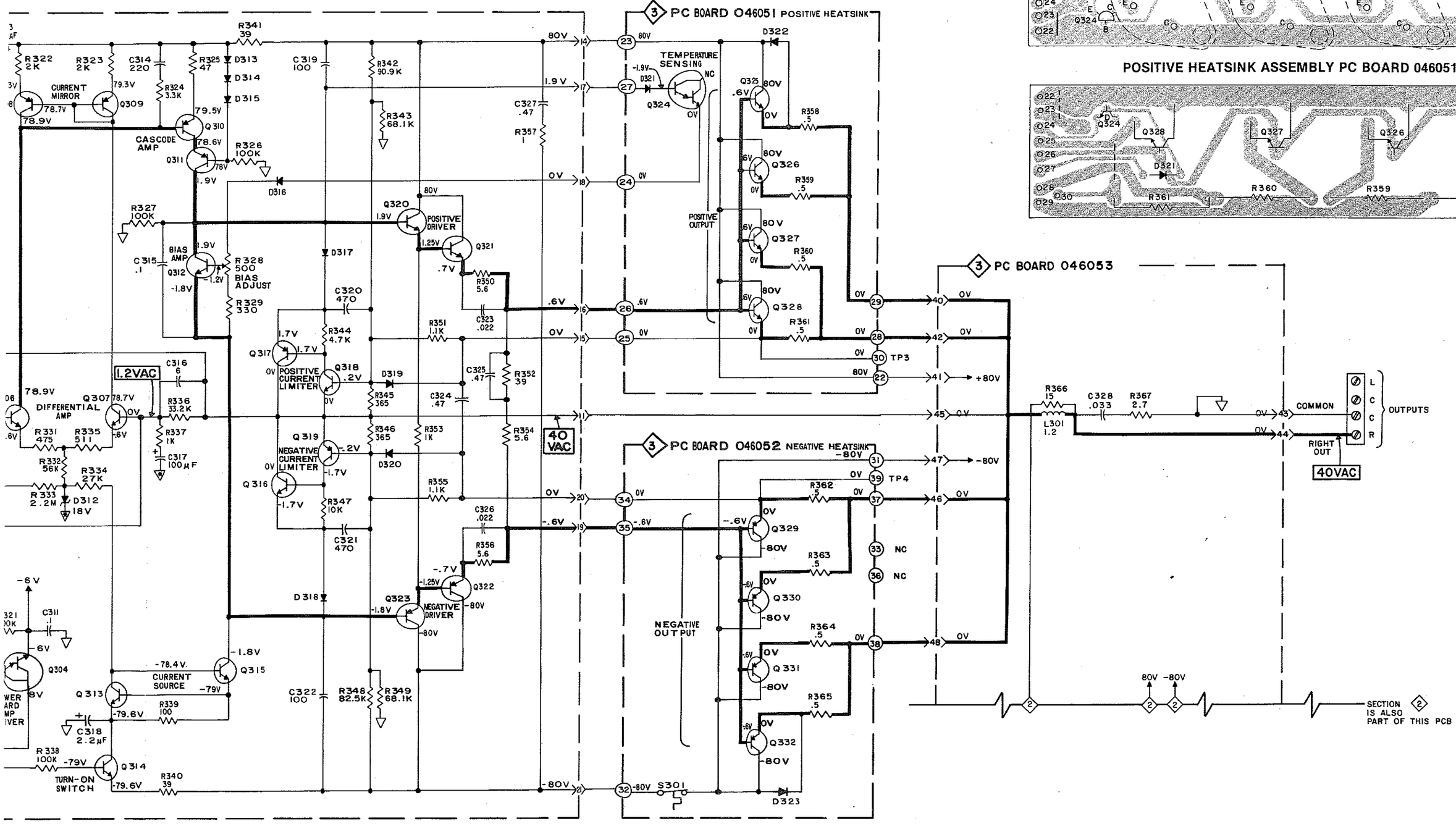
Q201-Q204, Q206-Q210, Q212-Q214, Q216-Q219, Q224, Q233, Q234, Q235

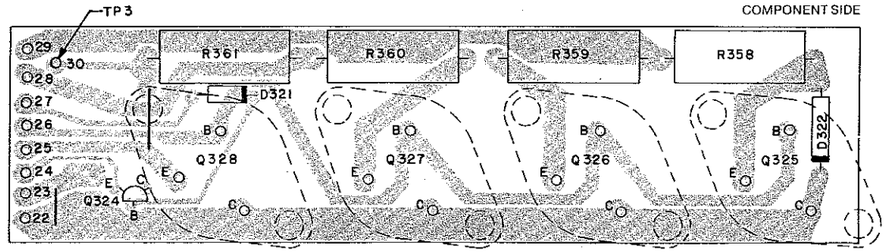


Q236

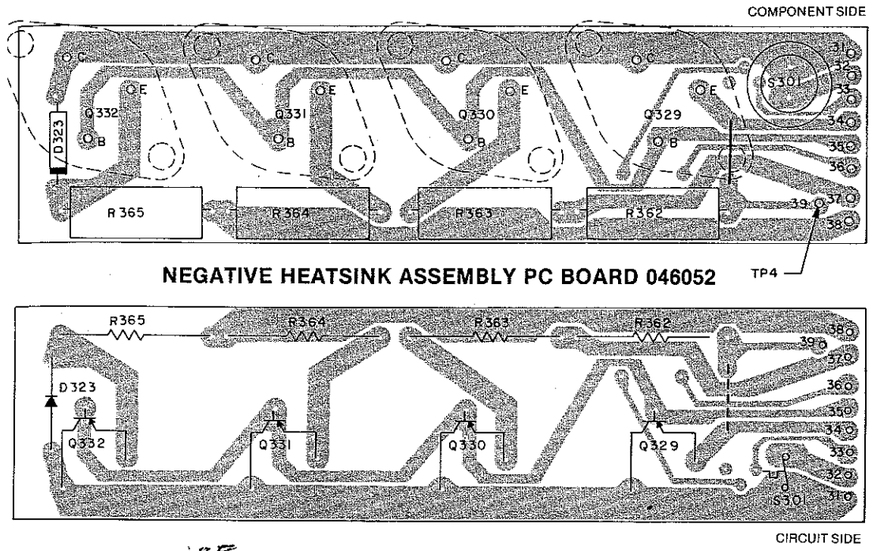
3 Amplifier (Right Channel)





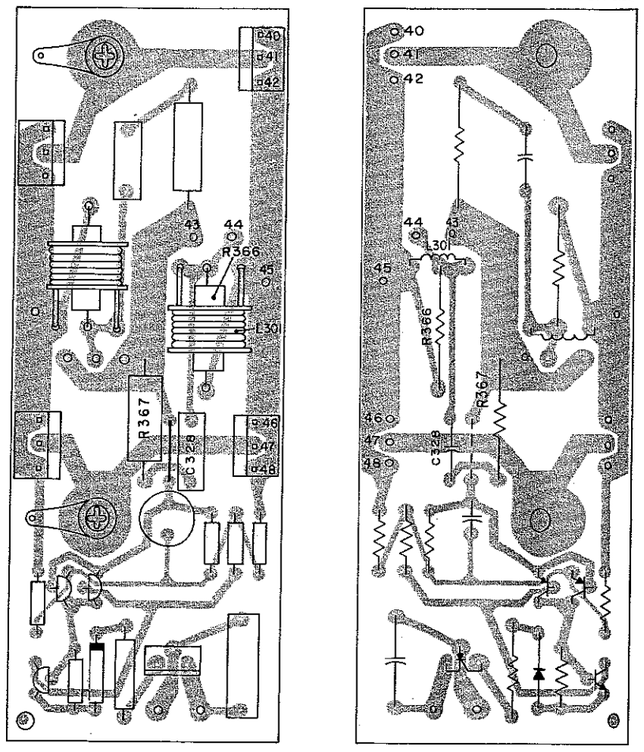


POSITIVE HEATSINK ASSEMBLY PC BOARD 046051

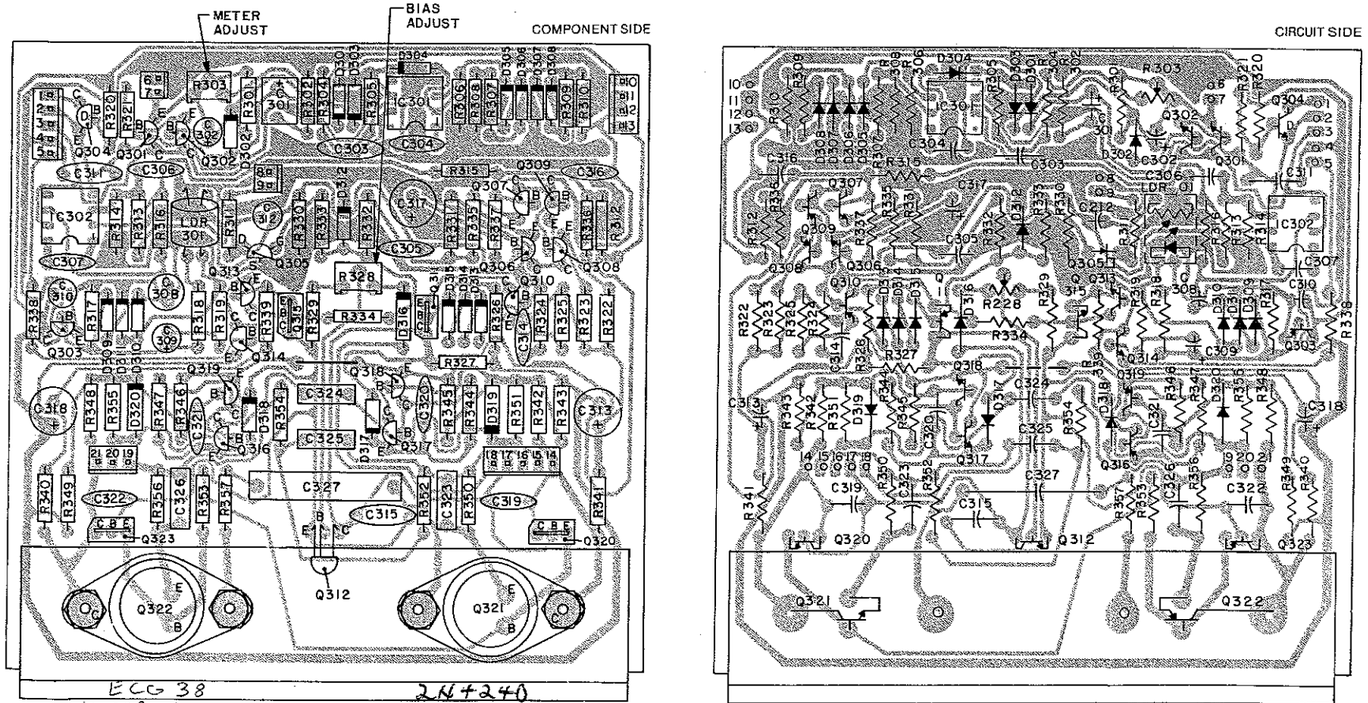


NEGATIVE HEATSINK ASSEMBLY PC BOARD 046052

185
213
8339



JUNCTION PC BOARD 046053



ECG 38
MOTOROLA
2N4240
2/6
8513

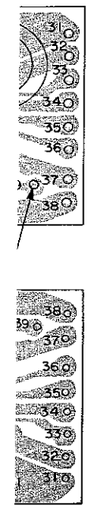
AMPLIFIER (LEFT CHANNEL) PC BOARD 046050

ECG 175

AMPLIFIER (RIGHT CHANNEL) PARTS LIST

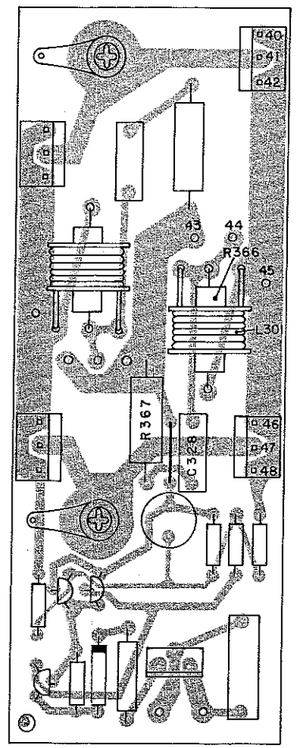
Symbol No.	Part No.	Description
CAPACITORS (MPE = Metalized Polyester, CD = Ceramic Disc, ELECT = Electrolytic)		
C301	064333	MPE, .47μF, 5%, 50V
*C302	066269	ELECT, 1μF, 50V
C303	061150	CD, 0.1μF, +80 – 20%, 50V, Z5V
C304	061023	CD, 100pF, 10%, 500V, N1500
C305	061023	CD, 100pF, 10%, 500V, N1500
C306	061087	CD, 3.3pF, 10%, 500V, NPO
C307	061087	CD, 3.3pF, 10%, 500V, NPO
*C308	066316	ELECT, 10μF, 25V, NP
C309	066215	ELECT, 47μF, 16V
*C310	066269	ELECT, 1μF, 50V
C311	061150	CD, 0.1μF, +80 – 20%, 50V, Z5V
*C312	066277	ELECT, 3.3μF, 20%, 50V, NP
C313	066357	ELECT, 2.2μF, 20%, 160V
C314	061027	CD, 220pF, 10%, 500V, Z5F
C315	061150	CD, 0.1μF, +80 – 20%, 50V, Z5V
*C316	061142	CD, 6pF, 5%, 500V, N470
C317	066226	ELECT, 100μF, 16V
C318	066357	ELECT, 2.2μF, 20%, 160V
C319	061023	CD, 100pF, 10%, 500V, N1500
C320	061128	CD, 470pF, 10%, 500V, Z5F
C321	061128	CD, 470pF, 10%, 500V, Z5F
C322	061023	CD, 100pF, 10%, 500V, N1500
C323	064246	MPE, .022μF, 10%, 63V
C324	064262	MPE, .47μF, 10%, 63V
C325	064262	MPE, .47μF, 10%, 63V
C326	064246	MPE, .022μF, 10%, 63V
C327	064340	MPE, .47μF, 10%, 250V
C328	064341	MPE, .033μF, 10%, 400V
DIODES (SIG = Signal, ZN = Zener, RECT = Rectifier, STAB = Stabistor, GE = Germanium)		
*D301	070047	SIG, 75V, 10mA, IN4148
*D302	070047	SIG, 75V, 10mA, IN4148
*D303	070047	SIG, 75V, 10mA, IN4148
*D304	070047	SIG, 75V, 10mA, IN4148
*D305	070047	SIG, 75V, 10mA, IN4148
*D306	070047	SIG, 75V, 10mA, IN4148
*D307	070047	SIG, 75V, 10mA, IN4148
*D308	070047	SIG, 75V, 10mA, IN4148
*D309	070047	SIG, 75V, 10mA, IN4148
*D310	070047	SIG, 75V, 10mA, IN4148
*D311	070047	SIG, 75V, 10mA, IN4148
*D312	070103	ZN, 18V, 5%, 500mW, IN5248B
*D313	070047	SIG, 75V, 10mA, IN4148
*D314	070047	SIG, 75V, 10mA, IN4148
*D315	070047	SIG, 75V, 10mA, IN4148
*D316	070046	STAB, 1.3V, 2%, 10mA, Selected MZ2361
*D317	070047	SIG, 75V, 10mA, IN4148
*D318	070047	SIG, 75V, 10mA, IN4148
*D319	070003	GE, SIG, 45V, 10mA, IN542
*D320	070003	GE, SIG, 45V, 10mA, IN542
*D321	070047	SIG, 75V, 10mA, IN4148
*D322	070031	RECT, 400 PIV, 1.5A
*D323	070031	RECT, 400 PIV, 1.5A
INTEGRATED CIRCUITS		
*IC301	133068	Operational Amp LM201AN
*IC302	133068	Operational Amp LM201AN ECG 975
COILS		
*L301	122228	Choke, 1.2μH
LIGHT DEPENDENT RESISTORS		
*LDR301	144179	LDR, VTL5C9
TRANSISTORS (N = N Channel, JFET = Junction FET, DAR = Darlington, SCR = Silicon Controlled Rectifier)		
*Q301	132195	NPN, Selected 2N6428A
*Q302	132195	NPN, Selected 2N6428A
*Q303	132172	PNP, MPS-A55
*Q304	132090	NPN, DAR, Selected MPS-A14
*Q305	132193	N, JFET, 2N4392
*Q306	132215	NPN, 2N5551
*Q307	132215	NPN, 2N5551
*Q308	132056	PNP, 2N5087
*Q309	132056	PNP, 2N5087
*Q310	132056	PNP, 2N5087
*Q311	132211	PNP, MDS60
*Q312	132171	NPN, MPS-A05
*Q313	132171	NPN, MPS-A05
*Q314	132136	NPN, MPS-A42
*Q315	132210	NPN, MDS21
*Q316	132171	NPN, MPS-A05
*Q317	132172	PNP, MPS-A55
*Q318	132171	NPN, MPS-A05
*Q319	132172	PNP, MPS-A55
*Q320	132210	NPN, MDS21
*Q321	132217	NPN ECG 17
*Q322	132216	PNP ECG 38
*Q323	132211	PNP, MDS60
*Q324	132090	NPN, DAR, Selec
*Q325	132212	NPN
*Q326	132212	NPN
*Q327	132212	NPN
*Q328	132212	NPN
*Q329	132213	PNP
*Q330	132213	PNP
*Q331	132213	PNP
*Q332	132213	PNP
RESISTORS (CF = Carbon Film, POT = I MF = Metal Film, FP = Flar WW = Wirewound)		
R301	141112	CF, 470kΩ, 5%,
R302	141152	CF, 47Ω, 5%, 1.
*R303	134383	POT, 100kΩ
R304	141090	CF, 56kΩ, 5%,
R305	141124	CF, 2.2MΩ, 5%,
R306	141072	CF, 10kΩ, 5%,
R307	141072	CF, 10kΩ, 5%,
R308	141074	CF, 12kΩ, 5%,
R309	141136	CF, 10Ω, 5%, 1.
R310	141082	CF, 27kΩ, 5%,
R311	141064	CF, 4.7kΩ, 5%,
*R312	144106	MF, 33.2kΩ, 1%
R313	141086	CF, 39kΩ, 5%,
R314	141124	CF, 2.2MΩ, 5%,
R315	141086	CF, 39kΩ, 5%,
R316	141124	CF, 2.2MΩ, 5%,
R317	141064	CF, 4.7kΩ, 5%,
R318	141037	CF, 330Ω, 5%,
R319	141152	CF, 47Ω, 5%, 1.
R320	141096	CF, 100kΩ, 5%,
R321	141096	CF, 100kΩ, 5%,
*R322	144094	MF, 2kΩ, 1%, 1
*R323	144094	MF, 2kΩ 1%, 1,
*R324	141060	CF, 3.3kΩ, 5%,
*R325	141152	CF, 47Ω, 5%, 1.
R326	141096	CF, 100kΩ, 5%,
R327	141096	CF, 100kΩ, 5%,
*R328	134410	POT, 500Ω, 20%
R329	141037	CF, 330Ω, 5%,
*R330	144141	MF, 27.4kΩ, 1%
*R331	144086	MF, 475Ω, 1%,
R332	141090	CF, 56kΩ, 5%,
R333	141124	CF, 2.2MΩ, 5%,
R334	141082	CF, 27kΩ, 5%,
*R335	144123	MF, 511Ω, 2%,
*R336	144106	MF, 33.2kΩ, 1%
*R337	144090	MF, 1kΩ, 1%, 1
R338	141096	CF, 100kΩ, 5%,
*R339	144163	FP, 100Ω, 5%,
*R340	144169	FP, 39Ω, 5%, 1.
*R341	144169	FP, 39Ω, 5%, 1.
*R342	144170	MF, 90.9kΩ, 1%
*R343	144081	MF, 68.1kΩ, 1%
R344	141064	CF, 4.7kΩ, 5%,
*R345	144071	MF, 365Ω, 1%,
*R346	144071	MF, 365Ω, 1%,
R347	141072	CF, 10kΩ, 5%,
*R348	144112	MF, 82.5kΩ, 1%
*R349	144081	MF, 68.1kΩ, 1%
*R350	144168	FP, 5.6Ω, 5%, 1

ENT SIDE

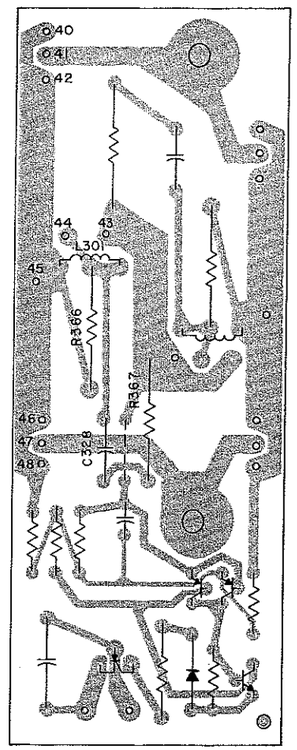


CUIT SIDE

COMPONENT SIDE

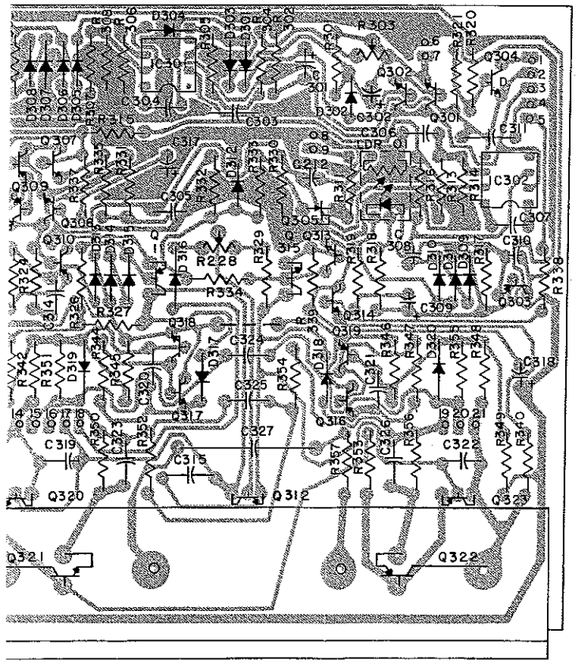


CIRCUIT SIDE



JUNCTION PC BOARD 046053

CIRCUIT SIDE

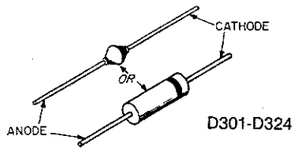


OARD 046050

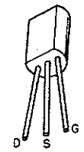
AMPLIFIER (RIGHT CHANNEL) PARTS LIST

Symbol No.	Part No.	Description
CAPACITORS (MPE = Metalized Polyester, CD = Ceramic Disc, ELECT = Electrolytic)		
C301	064333	MPE, .47μF, 5%, 50V
*C302	066269	ELECT, 1μF, 50V
C303	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
C304	061023	CD, 100pF, 10%, 500V, N1500
C305	061023	CD, 100pF, 10%, 500V, N1500
C306	061087	CD, 3.3pF, 10%, 500V, NPO
C307	061087	CD, 3.3pF, 10%, 500V, NPO
*C308	066316	ELECT, 10μF, 25V, NP
C309	066215	ELECT, 47μF, 16V
*C310	066269	ELECT, 1μF, 50V
C311	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
*C312	066277	ELECT, 3.3μF, 20%, 50V, NP
C313	066357	ELECT, 2.2μF, 20%, 160V
C314	061027	CD, 220pF, 10%, 500V, Z5F
C315	061150	CD, 0.1μF, +80 −20%, 50V, Z5V
*C316	061142	CD, 6pF, 5%, 500V, N470
C317	066226	ELECT, 100μF, 16V
C318	066357	ELECT, 2.2μF, 20%, 160V
C319	061023	CD, 100pF, 10%, 500V, N1500
C320	061128	CD, 470pF, 10%, 500V, Z5F
C321	061128	CD, 470pF, 10%, 500V, Z5F
C322	061023	CD, 100pF, 10%, 500V, N1500
C323	064246	MPE, .022μF, 10%, 63V
C324	064262	MPE, .47μF, 10%, 63V
C325	064262	MPE, .47μF, 10%, 63V
C326	064246	MPE, .022μF, 10%, 63V
C327	064340	MPE, .47μF, 10%, 250V
C328	064341	MPE, .033μF, 10%, 400V
DIODES (SIG = Signal, ZN = Zener, RECT = Rectifier, STAB = Stabistor, GE = Germanium)		
*D301	070047	SIG, 75V, 10mA, IN4148
*D302	070047	SIG, 75V, 10mA, IN4148
*D303	070047	SIG, 75V, 10mA, IN4148
*D304	070047	SIG, 75V, 10mA, IN4148
*D305	070047	SIG, 75V, 10mA, IN4148
*D306	070047	SIG, 75V, 10mA, IN4148
*D307	070047	SIG, 75V, 10mA, IN4148
*D308	070047	SIG, 75V, 10mA, IN4148
*D309	070047	SIG, 75V, 10mA, IN4148
*D310	070047	SIG, 75V, 10mA, IN4148
*D311	070047	SIG, 75V, 10mA, IN4148
*D312	070103	ZN, 18V, 5%, 500mW, IN5248B
*D313	070047	SIG, 75V, 10mA, IN4148
*D314	070047	SIG, 75V, 10mA, IN4148
*D315	070047	SIG, 75V, 10mA, IN4148
*D316	070046	STAB, 1.3V, 2%, 10mA, Selected MZ2361
*D317	070047	SIG, 75V, 10mA, IN4148
*D318	070047	SIG, 75V, 10mA, IN4148
*D319	070003	GE, SIG, 45V, 10mA, IN542
*D320	070003	GE, SIG, 45V, 10mA, IN542
*D321	070047	SIG, 75V, 10mA, IN4148
*D322	070031	RECT, 400 PIV, 1.5A
*D323	070031	RECT, 400 PIV, 1.5A
INTEGRATED CIRCUITS		
*IC301	133068	Operational Amp LM201AN
*IC302	133068	Operational Amp LM201AN ECG 975
COILS		
*L301	122228	Choke, 1.2μH
LIGHT DEPENDENT RESISTORS		
*LDR301	144179	LDR, VTL5C9
TRANSISTORS (N = N Channel, JFET = Junction FET, DAR = Darlington, SCR = Silicon Controlled Rectifier)		
*Q301	132195	NPN, Selected 2N6428A
*Q302	132195	NPN, Selected 2N6428A
*Q303	132172	PNP, MPS-A55
*Q304	132090	NPN, DAR, Selected MPS-A14
*Q305	132193	N, JFET, 2N4392
*Q306	132215	NPN, 2N5551
*Q307	132215	NPN, 2N5551
*Q308	132056	PNP, 2N5087
*Q309	132056	PNP, 2N5087
*Q310	132056	PNP, 2N5087
*Q311	132211	PNP, MDS60
*Q312	132171	NPN, MPS-A05
*Q313	132171	NPN, MPS-A05
*Q314	132136	NPN, MPS-A42
*Q315	132210	NPN, MDS21
*Q316	132171	NPN, MPS-A05
*Q317	132172	PNP, MPS-A55
*Q318	132171	NPN, MPS-A05
*Q319	132172	PNP, MPS-A55
*Q320	132210	NPN, MDS21
*Q321	132217	NPN ECG 175
*Q322	132216	PNP ECG 38
*Q323	132211	PNP, MDS60
*Q324	132090	NPN, DAR, Selected MPS-A14
*Q325	132212	NPN
*Q326	132212	NPN
*Q327	132212	NPN
*Q328	132212	NPN
*Q329	132213	PNP
*Q330	132213	PNP
*Q331	132213	PNP
*Q332	132213	PNP
RESISTORS (CF = Carbon Film, POT = Potentiometer, MF = Metal Film, FP = Flameproof, WW = Wirewound)		
R301	141112	CF, 470kΩ, 5%, 1/4W
R302	141152	CF, 47Ω, 5%, 1/4W
*R303	134383	POT, 100kΩ
R304	141090	CF, 56kΩ, 5%, 1/4W
R305	141124	CF, 2.2MΩ, 5%, 1/4W
R306	141072	CF, 10kΩ, 5%, 1/4W
R307	141072	CF, 10kΩ, 5%, 1/4W
R308	141074	CF, 12kΩ, 5%, 1/4W
R309	141136	CF, 10Ω, 5%, 1/4W
R310	141082	CF, 27kΩ, 5%, 1/4W
R311	141064	CF, 4.7kΩ, 5%, 1/4W
*R312	144106	MF, 33.2kΩ, 1%, 1/4W
R313	141086	CF, 39kΩ, 5%, 1/4W
R314	141124	CF, 2.2MΩ, 5%, 1/4W
R315	141086	CF, 39kΩ, 5%, 1/4W
R316	141124	CF, 2.2MΩ, 5%, 1/4W
R317	141064	CF, 4.7kΩ, 5%, 1/4W
R318	141037	CF, 330Ω, 5%, 1/4W
R319	141152	CF, 47Ω, 5%, 1/4W
R320	141096	CF, 100kΩ, 5%, 1/4W
R321	141096	CF, 100kΩ, 5%, 1/4W
*R322	144094	MF, 2kΩ, 1%, 1/4W
*R323	144094	MF, 2kΩ 1%, 1/4W
*R324	141060	CF, 3.3kΩ, 5%, 1/4W
*R325	141152	CF, 47Ω, 5%, 1/4W
R326	141096	CF, 100kΩ, 5%, 1/4W
R327	141096	CF, 100kΩ, 5%, 1/4W
*R328	134410	POT, 500Ω, 20%,
R329	141037	CF, 330Ω, 5%, 1/4W
*R330	144141	MF, 27.4kΩ, 1%, 1/4W
*R331	144086	MF, 475Ω, 1%, 1/4W
R332	141090	CF, 56kΩ, 5%, 1/4W
R333	141124	CF, 2.2MΩ, 5%, 1/4W
R334	141082	CF, 27kΩ, 5%, 1/4W
*R335	144123	MF, 511Ω, 2%, 1/4W
*R336	144106	MF, 33.2kΩ, 1%, 1/4W
*R337	144090	MF, 1kΩ, 1%, 1/4W
R338	141096	CF, 100kΩ, 5%, 1/4W
*R339	144163	FP, 100Ω, 5%, 1/4W
*R340	144169	FP, 39Ω, 5%, 1/4W
*R341	144169	FP, 39Ω, 5%, 1/4W
*R342	144170	MF, 90.9kΩ, 1%, 1/4W
*R343	144081	MF, 68.1kΩ, 1%, 1/4W
R344	141064	CF, 4.7kΩ, 5%, 1/4W
*R345	144071	MF, 365Ω, 1%, 1/4W
*R346	144071	MF, 365Ω, 1%, 1/4W
R347	141072	CF, 10kΩ, 5%, 1/4W
*R348	144112	MF, 82.5kΩ, 1%, 1/4W
*R349	144081	MF, 68.1kΩ, 1%, 1/4W
*R350	144168	FP, 5.6Ω, 5%, 1/4W
*R351	144091	MF, 1.1kΩ, 1%, 1/4W
*R352	144169	FP, 39Ω, 5%, 1/4W
*R353	144090	MF, 1kΩ, 1%, 1/4W
*R354	144168	FP, 5.6Ω, 5%, 1/4W
*R355	144091	MF, 1.1kΩ, 1%, 1/4W
*R356	144168	FP, 5.6Ω, 5%, 1/4W
R357	141001	CF, 1Ω, 5%, 1/4W
*R358	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R359	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R360	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R361	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R362	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R363	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R364	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R365	139163	WW, 0.5Ω, 3%, 5W, Noninductive
*R366	139139	WW, 15Ω, 10%, 2W
*R367	139002	WW, 2.7Ω, 10%, 2W
SWITCHES		
*S301	153018	Thermal Switch
MISCELLANEOUS		
*178118		TO-3 Socket

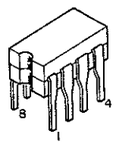
* Parts marked with an asterisk (*) are replacement parts stocked by our Service Department and must be ordered by part number. Parts not marked may be obtained from electronic parts suppliers.



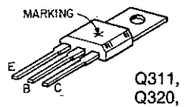
D301-D324



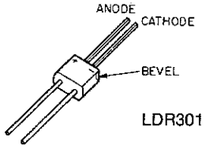
Q305



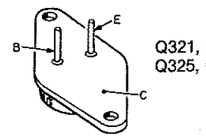
IC301, IC302



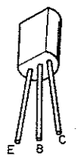
Q311, C
Q320, C



LDR301

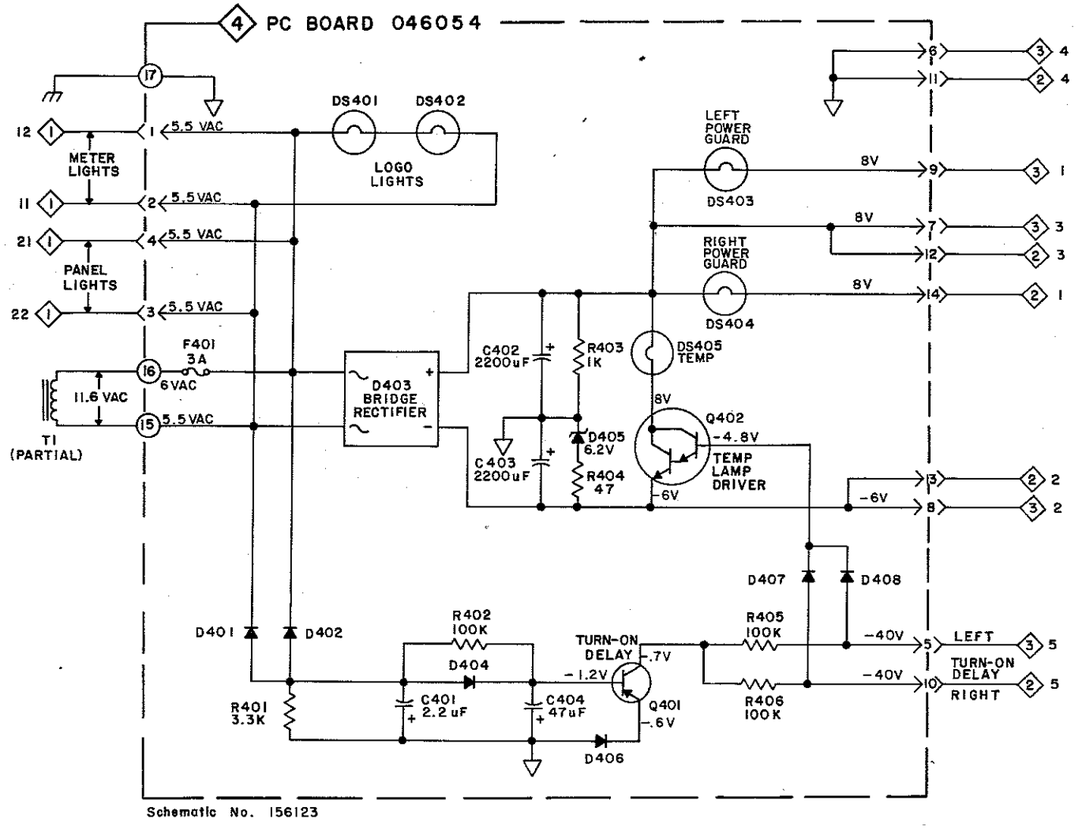


Q321, C
Q325, C



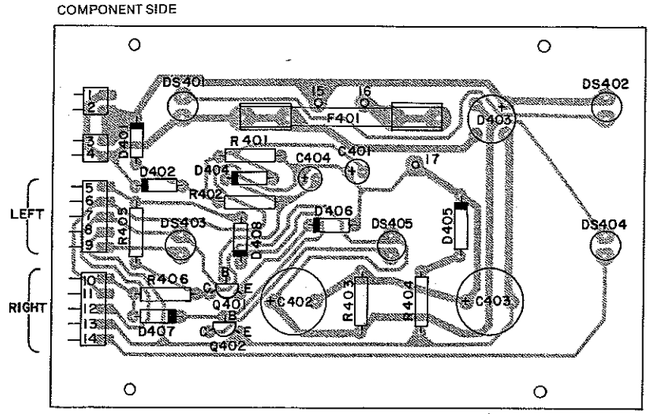
Q301-Q304
Q306-Q310
Q312-Q314
Q316-Q319
Q324

Power Supply/Display

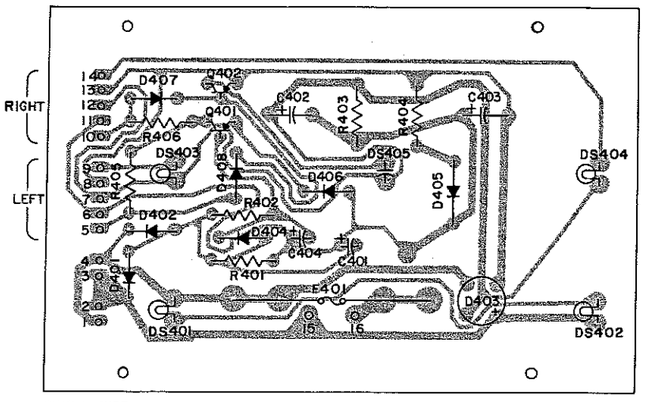


Schematic No. 156123

COMPONENT SIDE



POWER SUPPLY/DISPLAY BOARD 046054

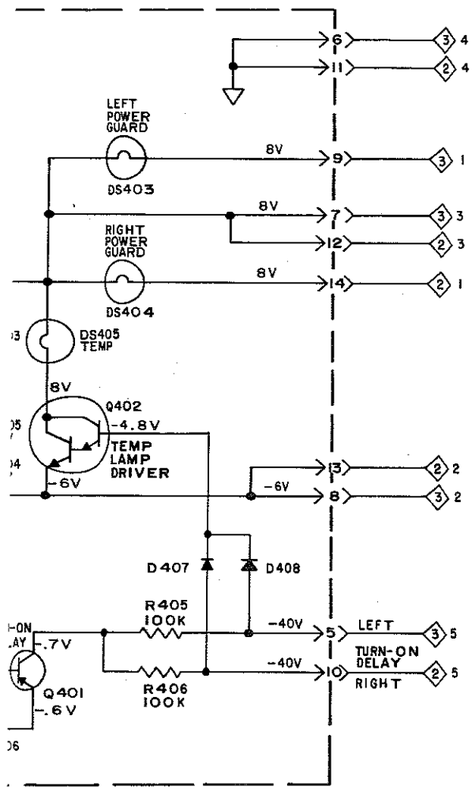


CIRCUIT SIDE

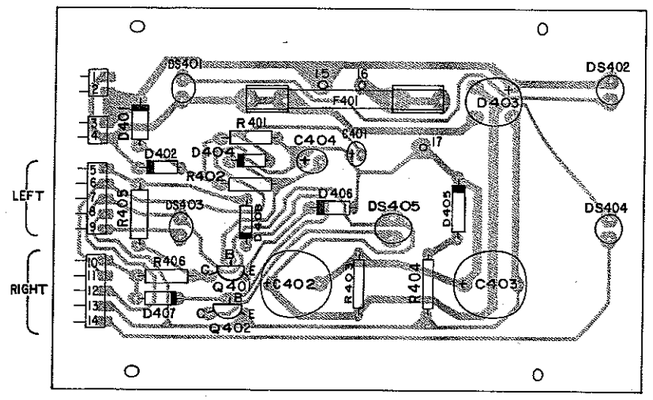
POWER SUPPLY/DIS PARTS LIST

Symbol No.	Part No.	
CAPACITORS (ELECT = Electrolyt		
C401	066237	ELECT, 2.
C402	066358	ELECT, 22
C403	066358	ELECT, 22
C404	066215	ELECT, 47
DIODES (SIG = Signal, BRID = Bi		
*D401	070047	SIG, 75V,
*D402	070047	SIG, 75V,
*D403	070112	BRID, 25V
*D404	070047	SIG, 75V,
*D405	070085	ZN, 6.2V,
*D406	070047	SIG, 75V,
*D407	070047	SIG, 75V,
*D408	070047	SIG, 75V,
LIGHTING DEVICES (INC = Incan		
*DS401	058062	INC, 6.3V
*DS402	058062	INC, 6.3V
*DS403	058061	INC, 14V,
*DS404	058061	INC, 14V,
*DS405	058061	INC, 14V,
FUSES (FA = Fast Acting)		
*F401	089005	Fuse, FA,
RESISTORS (CF = Carbon Film)		
R401	141060	CF, 3.3kΩ
R402	141096	CF, 100kΩ
R403	141049	CF, 1kΩ,
R404	141152	CF, 47Ω,
R405	141096	CF, 100kΩ
R406	141096	CF, 100kΩ
TRANSISTOR (DAR = Darlington)		
*Q401	132147	PNP, MPS
*Q402	132090	NPN, DAR

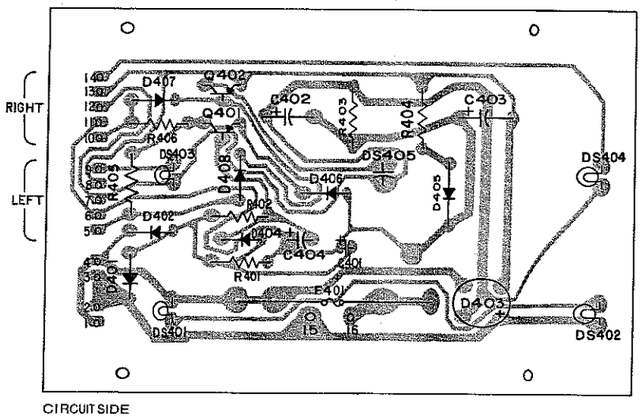
* Parts marked with an asterisk (* stocked by our Service Dep ordered by part number. Parts tained from electronic parts su



COMPONENT SIDE



POWER SUPPLY/DISPLAY BOARD 046054

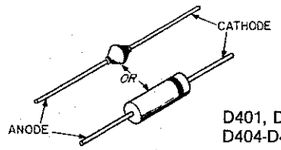


CIRCUIT SIDE

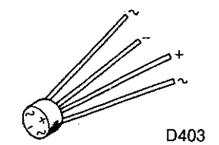
POWER SUPPLY/DISPLAY PARTS LIST

Symbol No.	Part No.	Description
CAPACITORS (ELECT = Electrolytic)		
C401	066237	ELECT, 2.2μF, 50V
C402	066358	ELECT, 2200μF, 10V
C403	066358	ELECT, 2200μF, 10V
C404	066215	ELECT, 47μF, 16V
DIODES (SIG = Signal, BRID = Bridge, ZN = Zener)		
*D401	070047	SIG, 75V, 10mA, IN4148
*D402	070047	SIG, 75V, 10mA, IN4148
*D403	070112	BRID, 25V, 1A, W110
*D404	070047	SIG, 75V, 10mA, IN4148
*D405	070085	ZN, 6.2V, 5%, 500mW, IN5234B
*D406	070047	SIG, 75V, 10mA, IN4148
*D407	070047	SIG, 75V, 10mA, IN4148
*D408	070047	SIG, 75V, 10mA, IN4148
LIGHTING DEVICES (INC = Incandescent)		
*DS401	058062	INC, 6.3V, 7381
*DS402	058062	INC, 6.3V, 7381
*DS403	058061	INC, 14V, 7382
*DS404	058061	INC, 14V, 7382
*DS405	058061	INC, 14V, 7382
FUSES (FA = Fast Acting)		
*F401	089005	Fuse, FA, 3A, 250V
RESISTORS (CF = Carbon Film)		
R401	141060	CF, 3.3kΩ, 5%, 1/4W
R402	141096	CF, 100kΩ, 5%, 1/4W
R403	141049	CF, 1kΩ, 5%, 1/4W
R404	141152	CF, 47Ω, 5%, 1/4W
R405	141096	CF, 100kΩ, 5%, 1/4W
R406	141096	CF, 100kΩ, 5%, 1/4W
TRANSISTOR (DAR = Darlington)		
*Q401	132147	PNP, MPS-A93
*Q402	132090	NPN, DAR, Selected MPS-A14

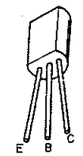
* Parts marked with an asterisk (*) are replacement parts stocked by our Service Department and must be ordered by part number. Parts not marked may be obtained from electronic parts suppliers.



D401, D402
D404-D408



D403



Q401, Q402

Alignment

BIAS ADJUSTMENT

The heatsinks must be cool for proper setting. Remove the top cover and operate the amplifier with no input signal. Adjust the bias for 20 ± 2 millivolts at the test points as follows: *Left Channel* - Connect the probes of a DC millivolt meter, negative to TP1 and positive to TP2. Adjust R228 (bias adjust) on the Amplifier PC board. *Right Channel* - Connect the probes of a DC millivolt meter, negative to TP4 and positive to TP3. Adjust R328 (bias adjust) on the Amplifier PC board.

METER ADJUSTMENT

Remove the top cover and check meter zero settings with the AC power off. Remove the front panel and adjust meter zero settings, if necessary. Connect and operate the amplifier at exactly 200 watts into 8 ohm loads with a 1kHz input. Adjust R203 (Left) and R303 (Right) for 200 on the WATTS AT 8 OHMS scale.

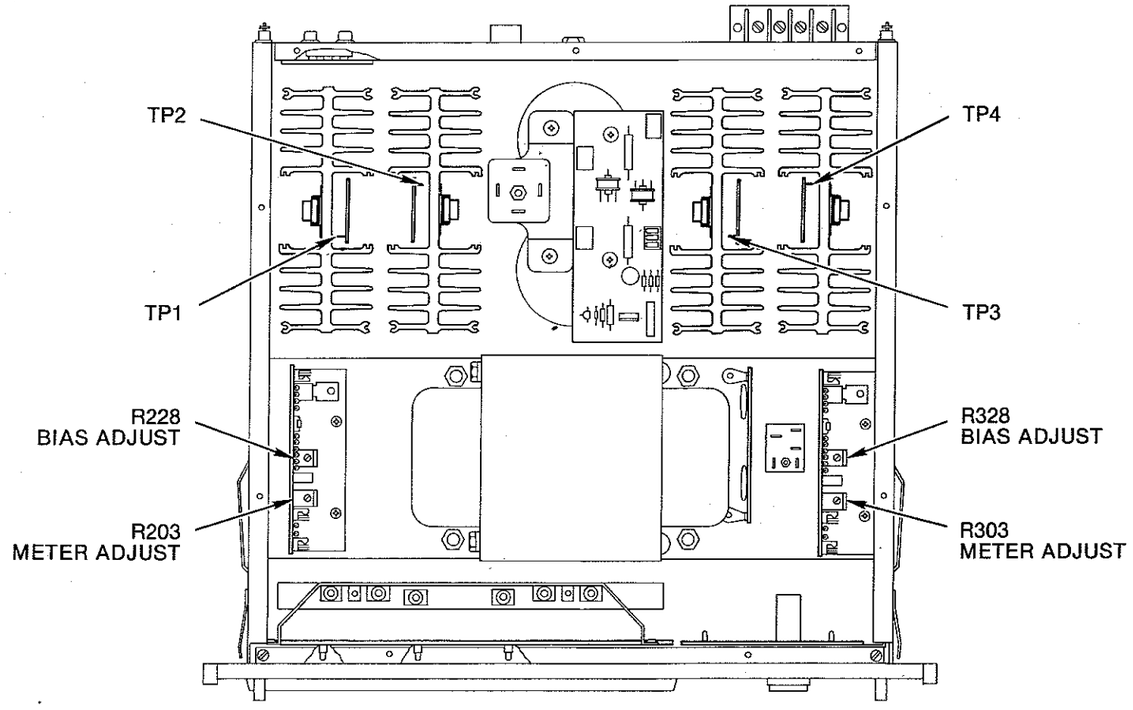


Fig. 6. Alignment locations.

Circuit Operation

Component numbers quoted below are for the left channel circuit. The input signal passes through an input attenuator switched to 0dB or −5dB by the INPUT LEVEL switch. The signal passes on to the Amplifier PC board where it is amplified by a differential amplifier, Q206 and Q207. The other input of the differential amplifier is from the negative feedback network, R236 and R237. The current mirror Q208 and Q209, combines the differential signal to a single output to drive the cascode gain stage, Q210 and Q211. The diode trio D213, D214 and D215 set the base voltage for Q211. The output drivers then amplify the current from the collector of Q211 in a complimentary Darlington circuit made up of Q220, Q221, Q222 and Q223. The output stage is also a complimentary circuit with four output transistors of each half connected in parallel. The output from each heatsink assembly is combined on the Junction PC board and passes through choke L201 to the speaker output terminals.

MONO OPERATION

Mono bridged operation is selected by MODE switch S2 on the Input PC board. In the MONO position, the right channel amplifier operates normally, and the left channel input is disabled. The right channel output is connected to the left channel feedback network through R312 on the Left Amplifier PC board. The left channel inverts the input with a gain of one.

TURN-ON DISPLAY

The bias of the entire amplifier is switched on after a time delay of about one second. The time delay is generated on the Power Supply PC board. D401, D402 and C401 develop a negative voltage from the 11.6 volt AC winding on the power transformer T1. This negative voltage slowly charges C404 through R402 to −1.2 volts where transistor Q401 conducts. Current from the collector of Q401 flows to the base of Q214 on the Amplifier PC board, which supplies −80 volts to the amplifier bias system.

AMPLIFIER BIAS and MUTING

The bias of the entire amplifier is switched by the turn-on delay system through Q214 which turns on the −80 volt current. The differential amplifier stage is regulated from −80 to −18 volts by Zener D812. This −18 volts also biases the gate of the output muting FET (Q205) to cut off, allowing the input signal to pass on the base of Q206. A 6 milliampere current source (Q215 and Q213) is also supplied by the switched −80 volts.

OUTPUT STAGE IDLE CURRENT

The power output stage bias is set by components that sense the temperature at various points to keep the idle current constant regardless of heatsink temperature. Q212 senses the temperature of driver transistors Q221 and Q222. D216 senses the temperature of predriver Q220 and Q223. The output heatsink temperature is sensed by Q224, and the temperature of R261 is measured by D221.

OUTPUT TRANSISTOR PROTECTION

The output transistors are protected against excessive dissipation by current limiters Q216, Q217, Q218 and Q219. The output current is sensed by measuring the voltage across R261 and R262. The current limit level is dynamically varied in response to the collector to emitter voltage. If the collector to emitter voltage is lowered, more current is allowed to the output terminals.

LOUDSPEAKER PROTECTION

The loudspeakers are protected against amplifier failure by a Crowbar circuit which triggers if there is more than 15 volts DC at the output terminals. The AC component of the output signal is removed by filter R268 and C229. Q233, Q234 and Q235 detect the presence of DC at either polarity of C229. They are connected so they latch ON if an error is detected. The emitter of Q233 triggers the gate of SCR, Q236. The SCR can conduct 400 amps, which effectively shorts the secondary of the power transformer T1. This will blow the 15A primary fuse F1.

TEMPERATURE PROTECTION

The negative heatsinks contain thermal switches that open if the temperature reaches 200°F. As the switch opens, the −80 volts is removed from the driver PC board which stops bias to the entire channel as described in the bias section during turn-on delay. When the −80 volts is off, the −40 volts at pin 5 of the Power Supply PC board falls to −5 volts. This causes the Temp Lamp Driver Q402 to conduct, lighting the TEMP lamp to indicate the thermal switch has tripped. Q402 conducts if either channel overheats, but the bias of each channel is independently disabled by a thermal switch.

POWER GUARD

The amplifier input and feedback signals are fed respectively into the noninverting and inverting inputs of the POWER GUARD amplifier/comparitor IC202. The output (distortion) is rectified by a bridge rectifier, D209, D210, D211 and the base-emitter junction of Q203. The rectified AC is filtered by C209 and fed to the LED section of LDR201. The LED illuminates if distortion is present, causing reduced resistance in the light-dependent resistor section. LDR201 and R211 form a voltage divider which attenuates the amplifier input signal. Q203 and Q204 amplify the rectified distortion sufficiently to light the POWER GUARD lamp, DS403 on the Power Supply PC board.

METERS

The speaker output flows through R210 to diodes D207 and D208, which convert the linear input to logarithmic curves to expand the meter dynamic range (50dB). D205 and D206 are steering diodes for the rectifier IC201. Positive signals are routed to the positive input, and negative signals to the negative input. The output of IC201 is therefore positive for either polarity of signal voltage, performing full-wave rectification. The rectified voltage flows through D201 and charges capacitor C201.

SHORT-TIME HOLD. The output of IC201 also charges C202 through D203. When the signal is reduced, C202 discharges through R201 until its voltage is low enough that D202 conducts. Unless D202 is conducting, there is no discharge path for C201, so it keeps its charge, holding the peak for about 300 milliseconds until D202 conducts to discharge it.

DC AMP and FEEDBACK. Q201 and Q202 boost the current from the rectifier circuit to drive the meter M1. The sensitivity (and calibration) of the meter drive circuit is set by a negative feedback loop, consisting of R203, R204 and R208.

POWER SUPPLY

The primary voltage to the power transformer T1 is switched by relay K1. Its 110 volt DC coil is powered by a DC supply, D2 and C5, and switched by the pushbutton POWER switch. Low voltage DC source and indicator lamps (power supply PC board), and all panel lamps are powered by the 11.6 volt secondary of T1. This winding, floating to chassis ground, is full-wave rectified by D403 and filtered by C402 and C403. The DC ground reference is set by R403 and Zener D405. The low voltage DC negative output is regulated to -6 volts by D405, and the $+8$ volts is unregulated.