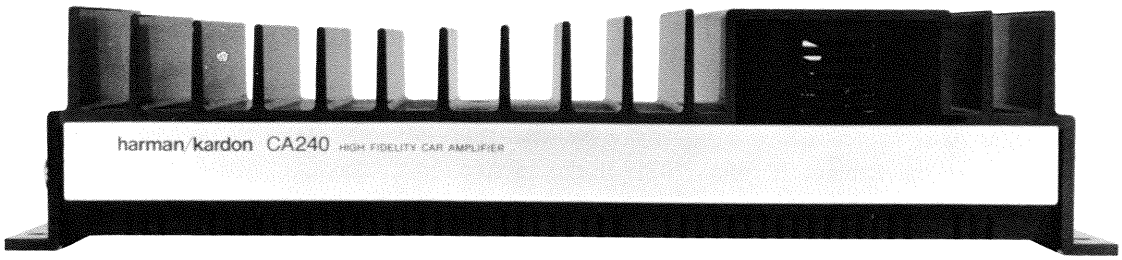
The Harman Kardon
Model CA240

Manual 82A

HIGH FIDELITY CAR AMPLIFIER

Technical Manual



harman/kardon
240 Crossways Park West, Woodbury, N.Y. 11797
1112-H15282A6 P-088501 1850 Printed in Japan

SPECIFICATIONS

Power Output, RMS : 40 watts per channel into 4 Ohms, 20 ~ 20,000Hz
: 50 watts per channel into 2 Ohms, 20 ~ 20,000Hz
: 100 watts bridged mono into 4 Ohms, 20 ~ 20,000Hz
HCC (High Instantaneous Current Capability) : ±25A
THD (4 Ohms/2 Ohms) : No more than 0.1%/0.2%
Negative Feedback : 25dB
Power Bandwidth : 10Hz to 100,000Hz
Frequency Response : 10Hz to 100,000Hz +0, −3dB
Signal-to-Noise Ratio : 80dB
Input Sensitivity : 0.25 ~ 3V Adjustable
Active Crossover Characteristics
High Pass : 200Hz, 12dB/Octave
Low Pass : 200Hz, 12dB/Octave
Power Supply : DC +13.8V (11 ~ 16V usable), negative ground
Typical Input Current Requirements
At Idle : 1.9A
Full Power Music Signal: 4A (4 Ohms/ch.)
: 6A (2 Ohms/ch.)
Full Power Sine Wave : 12A (4 Ohms/ch.)
: 18A (2 Ohms/ch.)
Dimensions (W x H x D) : 12-1/4"x2-11/16"x8" (310 x 68 x 203 mm)
Weight : 5 lbs. 12 oz. (2.6 kg)

Specifications and components subject to change without notice.
Overall performance will be maintained or improved.

DISASSEMBLY PROCEDURES (REFER TO PAGES 4 AND 8)

1 CABINET BOTTOM (143) REMOVAL

Remove 6 screws Ⓐ and remove the Cabinet Bottom (143).

2 MAIN (PCB-1) AND FILTER (PCB-2) P.C. BOARDS REMOVAL

1. Remove the Cabinet Bottom (143). (Refer to step 1 .)
2. Remove the Insulator (159).
3. Remove 11 screws Ⓑ and remove the Frame (141) with Bracket (162).
4. Remove 10 screws Ⓒ and remove the Main P.C. Board (PCB-1) with Filter P.C. Board (PCB-2). If necessary, unsolder the lead wires.

ALIGNMENT PROCEDURES (REFER TO PAGES 7 AND 8)

Conditions:

- Connect a 13.8V power supply to the 12V BATTERY POWER IN terminal.
- After the power on, wait for 5 minutes before measuring to be sure of the most stable operation.

IDLING CURRENT ADJUSTMENT

Step	Connection Equipments	Adjustment	For
1	Connect the DC voltmeter to TP1 (+) and TP2 (−).	VR401	33mV
2	Connect the DC voltmeter to TP3 (+) and TP4 (−).	VR402	33mV

After the adjustment is complete, let the unit settle down for 10 minutes, than double-check that the idling current is set properly.

CIRCUIT DESCRIPTION

General Description of the CA240 Power Supply

The power supply voltages for the Power Amplifier are generated by means of a switching power supply. The switching power supply consists of transformer L2, transistors Q5 through Q9, transformer T1 and bridge rectifiers D12 through D16. This switching power supply is connected to associated circuits which control the initial turn on delay, thermal protection and load protection.

Circuit Description of Switching Power Supply

Under normal operating conditions the collector of Q2 is +8.1 volts and Q3 and Q4 are turned off.
Assume switching transistors Q5 and Q6 are initially turned on by a base current which is supplied through R13, D7 and the L2 secondary winding. The collector currents of Q5 and Q6 will flow through one of the L2 primary windings and one-half of the T1 primary winding thereby generating a voltage in the T1 feedback winding.
This voltage causes a current to flow through the L2 secondary winding via R17 and the center tap of L2. This current also flows through the base emittor junctions of Q5 and Q6, D8, D9 and Q9. This current keeps Q5 and Q6 on.
The purpose of D8, D9 and Q9 is to develop a negative bias voltage which speeds up the switching time of Q5 through Q8. The voltage across the L2 secondary winding continues to rise until core L2 saturates. At the moment L2 saturates the voltage generated by the L2 secondary winding reverses, Q5 and Q6 are turned off and Q7 and Q8 are turned on. This causes a current to flow in the opposite half of the T1 primary winding. The

T1 feedback winding and the L2 winding now provide the feedback necessary to keep Q7 and Q8 on until the L2 core saturates in the opposite direction, and the process repeats itself at a frequency of approximately 25kHz.

The L2 current feedback windings provide current drive for the switching transistors based on secondary loading of T1. If the load of T1 is increased, the base drive of the switching transistors is also increased.

Principle of Operation of Associated Control Circuits

Initial turn-on delay, thermal protection and load protection are controlled by: IC1, Q1, Q2, PT1, PT2, Q11, Q12, D25, Q405, Q406, Q407, Q408 and D25.

Power Turn-On Delay

When 12 volts is applied to the REMOTE terminal the power LED illuminates and due to low resistance of PT1 and PT2, Pins 8 and 9 of IC1 are low. Therefore, Pin 10 of IC1 is high. C1 is initially discharged and, therefore, Pin 1 of IC1 is initially low.

This causes Pin 3 of IC1 to go high. Pins 5 and 6 of IC1 are also kept high due to the charging current through C2 and R3.

IC1 Pin 4 goes low the thereby keeping Pin 3 of IC1 high until C2 charges up through R3. When C2 becomes charged Pins 5 and 6 of IC1 go low, and Pin 4 of IC1 goes high.

When Pin 4 goes high, Pin 12 of IC1 goes high, Pin 11 of IC1 goes low thereby turning on Q2, turning on the switching power supply. At the same time Pin 2 of IC1 goes high, Pin 1 of IC1 has become high since C1 has charged and Pine 3 of IC1 goes low discharging C2 through D2, thereby resetting the time delay circuit. This turn-on process takes approximately 3 seconds.

Thermal Protection

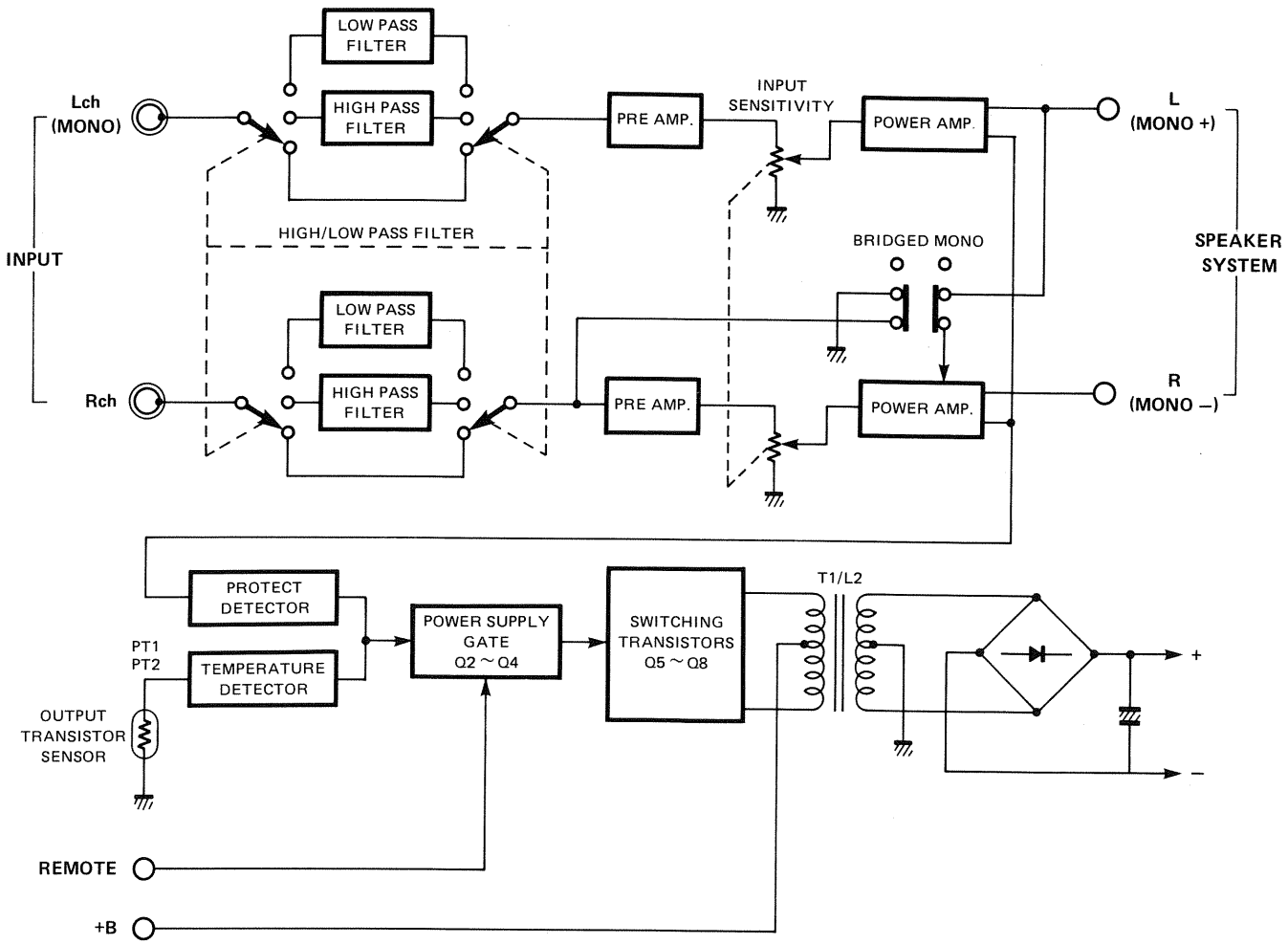
If the temperature of the heatsink exceeds 85 degrees C the resistance of PT1 and PT2 increases causing Pins 8 and 9 of IC1 to go high. Pin 10 of IC1 will go low, Pin 13 of IC1 will go low and Pin 11 will go high, thereby turning off Q2 which turns off the switching power supply until the temperature of the heatsink goes down. At that moment Pin 10 of IC1 goes high, the time delay circuit is reactivated and the power supply is turned on after the time delay period. R8 provides some hysteresis to prevent the thermal protection circuit from oscillating.

Load Protection

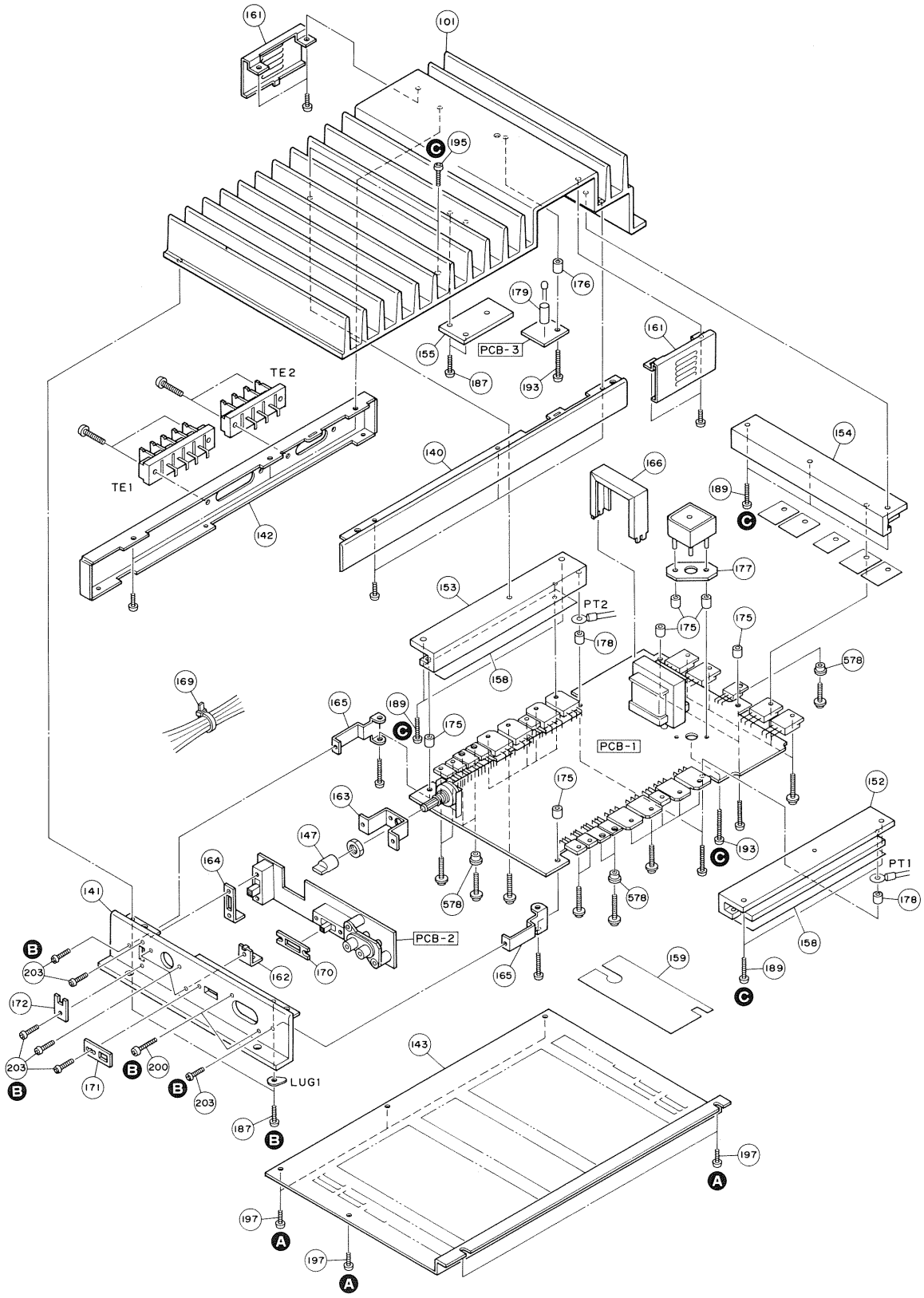
If the load connected to the output terminals drops below 1.3 ohms or consists of a short circuit, transistors Q11 or Q12 are turned on, thereby turning on SCR D25 which turns off Q405 through Q408. When Q405 through Q408 are turned off, the differential input transistors Q401 through Q404 are turned off and the power amplifier stages are turned off. At the same moment, Q1 is turned on, thereby turning off the switching power supply and reactivating the turn-on delay circuit. SCR D25 resets during the time delay period. At that moment the switching power supply circuit and power amplifier are turned back on.

The above process repeats itself until the low load impedance or short circuit is removed.

BLOCK DIAGRAM



GENERAL UNIT EXPLODED VIEW



GENERAL UNIT PARTS LIST

Ref. No.	Part No.	Description
101	B222-CA240A	Heat Sink Assembly
140	1443-08901	Front Panel
141	1563-03401	Frame
142	1424-14501	Cabinet Back
143	1424-14601	Cabinet Bottom
147	1632-13901	Rotary Knob, Input Sensitivity

Ref. No.	Part No.	Description
152	2222-7175	Heat Sink
153	2222-7176	Heat Sink
154	2222-7177	Heat Sink
155	2222-7178	Heat Sink
158	2224-7099	Insulator
159	2224-7104	Insulator
161	2219-8023	Bracket
162	2219-8024	Bracket
163	2219-8025	Bracket
164	2219-8026	Bracket
165	2219-8028	Bracket
166	2219-8046	Bracket
169	2240-7120	Holder
170	2240-7225	Holder
171	2240-7232	Holder
172	2240-7233	Holder
175	2132-7120	Spacer
176	2132-7123	Spacer
177	2132-7132	Spacer
178	2132-7134	Spacer
179	2132-7135	Spacer
187	2347-300826	Self-Tapping Screw (+) (3 x 8 mm)
189	2347-301026	Self-Tapping Screw (+) (3 x 10 mm)
193	2347-301626	Self-Tapping Screw (+) (3 x 16 mm)
195	2347-3008K6	Self-Tapping Screw (+) (3 x 8 mm)
197	2347-3006K7	Self-Tapping Screw (+) (3 x 6 mm)
200	2347-3010K1	Self-Tapping Screw (+) (3 x 10 mm)
203	2327-2608K9	Screw (+) (2.6 x 8 mm)
578	2114-YC40B	Bushing (Q9, Q421, Q422, Q425, Q426)
	1111-J30195	Owner Guide (for U.S.A. model)
	1111-J30196	Owner Guide (for General model)
	1221-717175	Packing Box
	1222-7272	Packing Cushion (x 2)

ELECTRICAL PARTS LIST

Ref. No.	Part No.	Description
	CHASSIS MISCELLANEOUS	
TE1	4214-147	Terminal, Speaker System
TE2	4214-148	Terminal, 12V Battery Power In
LUG1	4211-4	Lug Terminal
	4163-701120	Power Cord (Red), Ground Cord (Black), Remote Cord (Orange) and Spade Lug with Tube in 1 Package (Accessory)
	4472-7736	Auto Fuse (20A) with Holder (Accessory)
	2219-8027	Fuse Holder Mounting Bracket (Accessory)
	2310-7029	Mounting Screws and Washers (Accessory)
	1756-10601	Installation Template (Accessory)
	PCB-1 MAIN P.C. BOARD	
	RESISTORS	
R17	5173-330571	33Ω, ±5%, 2W, Metal
R415, 416	5174-241381	240Ω, ±1%, 1/4W, Metal
R427, 428, 429, 430	5102-1514713	150Ω, ±2%, 1/4W, Fuse
R449, 450	5174-470381	47Ω, ±1%, 1/4W, Metal
R451, 452, 453, 454, 455, 456, 457, 458	5273-R33672	0.33Ω, ±10%, 3W x 2 , Cement (Special Dual)
R463, 464	5171-3R3572	3.3Ω, ±5%, 1W, Metal
R465, 466	5173-220571	22Ω, ±5%, 2W, Metal
	CONTROLS	
VR401, 402	5101-3317673	330ΩB
VR501, 502	5113-50271134	5kΩB, Input Sensitivity
	CAPACITORS	
C2, 3	5345-106C041	10μF, ±20%, 16V, Electrolytic
C6	5345-476C0921	47μF, ±20%, 16V, Electrolytic
C7, 8	5345-228D0921	2200μF, ±20%, 25V, Electrolytic
C9, 10, 15, 16	5345-476E0921	47μF, ±20%, 35V, Electrolytic
C11, 12, 13, 14	5345-338E0962	3300μF, ±20%, 35V, Electrolytic

Ref. No.	Part No.	Description
C24	5345-227C041	220μF, ±20%, 16V, Electrolytic
C401, 402	5345-225F0951	2.2μF, ±20%, 50V, Electrolytic
C403, 404	5359-3315851	330pF, ±5%, 100V, Polypropylene
C405, 406	5345-227A0952	220μF, ±20%, 6.3V, Electrolytic
C407, 408	5359-1515851	150pF, ±5%, 100V, Polypropylene
C409, 410, 411, 412	5345-226E041	22μF, ±20%, 35V, Electrolytic
C417, 418	5345-476C041	47μF, ±20%, 16V, Electrolytic
C421, 422, 423, 424	5345-476E041	47μF, ±20%, 35V, Electrolytic
C431, 432	5353-030934	3pF, ±0.5pF, 500V, Mica
C515, 516	5345-107C041	100μF, ±20%, 16V, Electrolytic
	INTEGRATED CIRCUIT	
IC1	5654-MN4011B	MN4011B
	TRANSISTORS	
Q1, 405, 406, 407, 408	5613-2603(F)	2SC2603(F)
Q2, 11, 12, 409, 410, 411, 412	5611-992(F)	2SA992(F)
Q3	5613-3246(H)	2SC3246(H)
Q4	5611-1286(H)	2SA1286(H)
Q5, 6, 7, 8	5613-2626	2SC2626
Q9	5613-3345(O)	2SC3345(O)
Q401, 402, 403, 404	5613-2240(BL)	2SC2240(BL)
Q413, 414	5612-646(C)	2SB646(C)
Q415, 416	5614-666(C)	2SD666(C)
Q417, 418, 419, 420	5614-669(C)	2SD669(C)
Q421, 422	5613-2591(Q)	2SC2591(Q)
Q423, 424	5612-649(C)	2SB649(C)
Q425, 426	5611-1111(Q)	2SA1111(Q)
Q427, 428, 429, 430	5613-3181(R)	2SC3181(R) or 2SC3181(O)
Q431, 432, 433, 434	5611-1264(R)	2SA1264(R) or 2SA1264(O)
	DIODES	
D1, 2, 7, 21, 22, 24, 26, 27	5631-1S2473	1S2473
D3	5635-HZ9A-2L	Zener, HZ9A-2L
D5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 405, 406, 407, 408	5632-10DF2	10DF2
D12	5685-PB101F	Bridge Silicon, PB101F
D17	5632-ERC102FL	ERC102FL
D23	5635-HZ6B-2L	Zener, HZ6B-2L
D25	5661-CR02AM4	Silicon Controlled Rectifier, CR02AM-4
D401, 402, 403, 404	5636-1S2471	1S2471
D501, 502	5635-HZ12B2L	Zener, HZ12B2L
	COILS	
L2	5995-701083	
L3, 4, 405, 406	5991-7165	
L401, 402, 403, 404	5597-45502	
	MISCELLANEOUS	
T1	5584-701499	Power Transformer
PT1, 2	5192-330014	Posistor
	PCB-2 FILTER P.C. BOARD	
	RESISTOR	
R529	5174-133381	13kΩ, ±1%, 1/4W, Metal
	CAPACITORS	
C501, 502, 521, 522	5345-475D044	4.7μF, ±20%, 25V, Electrolytic
C511, 512, 513, 514	5345-226C044	22μF, ±20%, 16V, Electrolytic
	TRANSISTORS	
Q501, 502	5611-999L(F)	2SA999L(F)
Q503, 504	5613-2320L(F)	2SC2320L(F)
	MISCELLANEOUS	
SW501	4421-043016	Slide Switch, Filter (200Hz)
SW502	4421-0227124	Slide Switch, Bridged Mono
J1/2	4482-7117	2-Pin Jack, Input
	PCB-3 POWER INDICATOR P.C. BOARD	
D4	5637-GL5HD10	L.E.D., GL5HD10, Red, Power Indicator

SCHEMATIC DIAGRAM

PCB-2 1/2

PCB-1

SIGNAL PATH

L J1 (MONO)

R J2

INPUT

SW501
FILTER(200Hz)

INPUT SENSITIVITY

Q501 2SA999L(F)

Q502 2SA999L(F)

Q503 2SC2320L(F)

Q504 2SC2320L(F)

D26,27 : IS2473

D25 CR02AM-4

D24 IS2473

D502 HZ12B-2L

13.8V

: DIAGRAM

B-2 1/2

PCB-1

SW501
FILTER(200Hz)

INPUT SENSITIVITY

IDLING CURRENT ADJ. (Lch)

IDLING CURRENT ADJ. (Rch)

NFB SIGNAL

TP1 TP2 TP3 TP4

D26,27 : IS2473

E F G H I J K

NFB SIGNAL

IDLING CURRENT ADJ. (Lch)

IDLING CURRENT ADJ. (Rch)

PCB-2 2/2

BRIDGED MONO

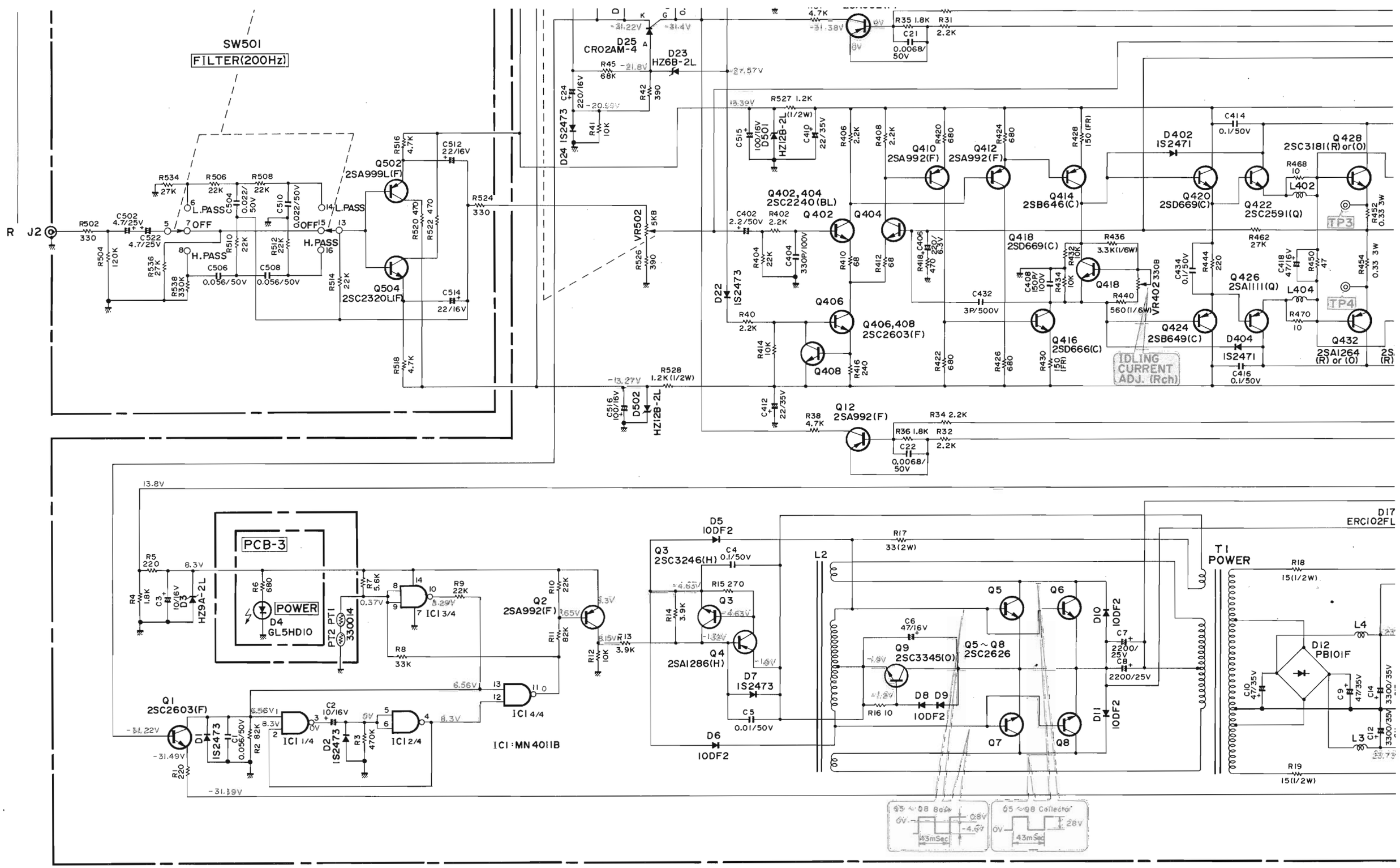
TE1 SPEAKER SYSTEM

(MONO ⊕)

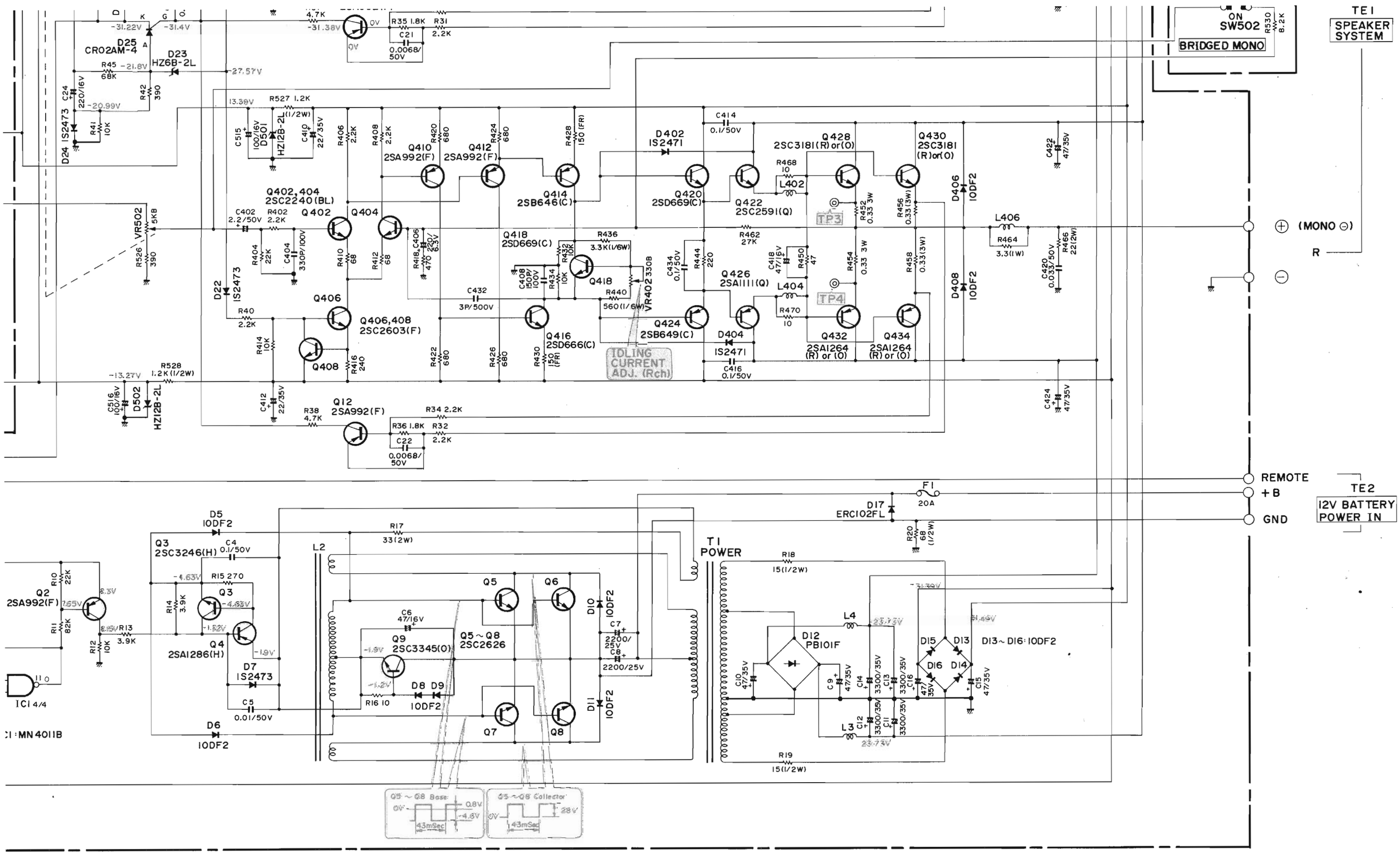
L

(MONO ⊖)

R



1. ALL RE
KΩ=10
2. THE W
3. ALL CA
4. V: DC



1. ALL RESISTANCES VALUES ARE IN Ω.
   KΩ=1000Ω, MΩ=1000KΩ.
2. THE WATTAGE OF RESISTORS IS 1/4W UNLESS OTHERWISE NOTED.
3. ALL CAPACITANCES VALUES ARE IN μF UNLESS OTHERWISE NOTED. P=μμF
4. V: DC VOLTAGE AT NO SIGNAL

B | C | D | E | F | G | H

DIAGRAM

SPEAKER SYSTEM
(MONO ⊕) R L (MONO ⊖)

12V BATTERY
GND +B

RED BLK BLK BLU

BLK RED

PT1 PT2

BLU BL

PCB-2

SW 502
BRIDGED
MONO

ON OFF

R530 R529

RED BLU

R524 R518 R522

C514 Q504 C512

R519 R523

Q502 Q501 C511

R520 R521

R516 R517 C513

Q503

R514 R513

C510 C509

PCB-1

INPUT
SENSITIVITY

VR501 VR502

Q419 Q423 Q421 Q425 Q427 Q431 Q417 Q429 Q433

R443 C433 C413 D401 Q403 L401 R467 L403 R469

R525 C407 R427 R423 C401 Q413 Q411 Q415 R425 C415 R429 R421 R413 C431 Q409 Q407 R419 R407 R405 R401 R403 Q401 R411 R409 R417 C403 C405 R415 Q405 R461 R526 C406

VR401 C423 R431 R433 R435 R439 R449 C417 C24 D24 R41 R43 R45 D27 R44 R26 C23 C16 C15 D15 D16 R455 R457 R451 TP1 TP2 R453 C421 C409 C411 D405 L405 R465 R463 D407 R31 R33 D23 R37 R35 Q11 C21 C419 R39 D21 D22 R38 R18 R19 R36 R22 R42 R5 R7 R8 R9 Q25 G K

IDLING CURRENT
ADJ. (Lch)

harman/kardon

RED BLK BLU

E F G H I J K

SPEAKER SYSTEM
(MONO ⊕) R L (MONO ⊖)

12V BATTERY POWER IN
GND +B REMOTE

PCB-3

POWER IND.

PT1 PT2

TI POWER

IDLING CURRENT ADJ. (L.ch)

TP1 TP2

VR401

IC1

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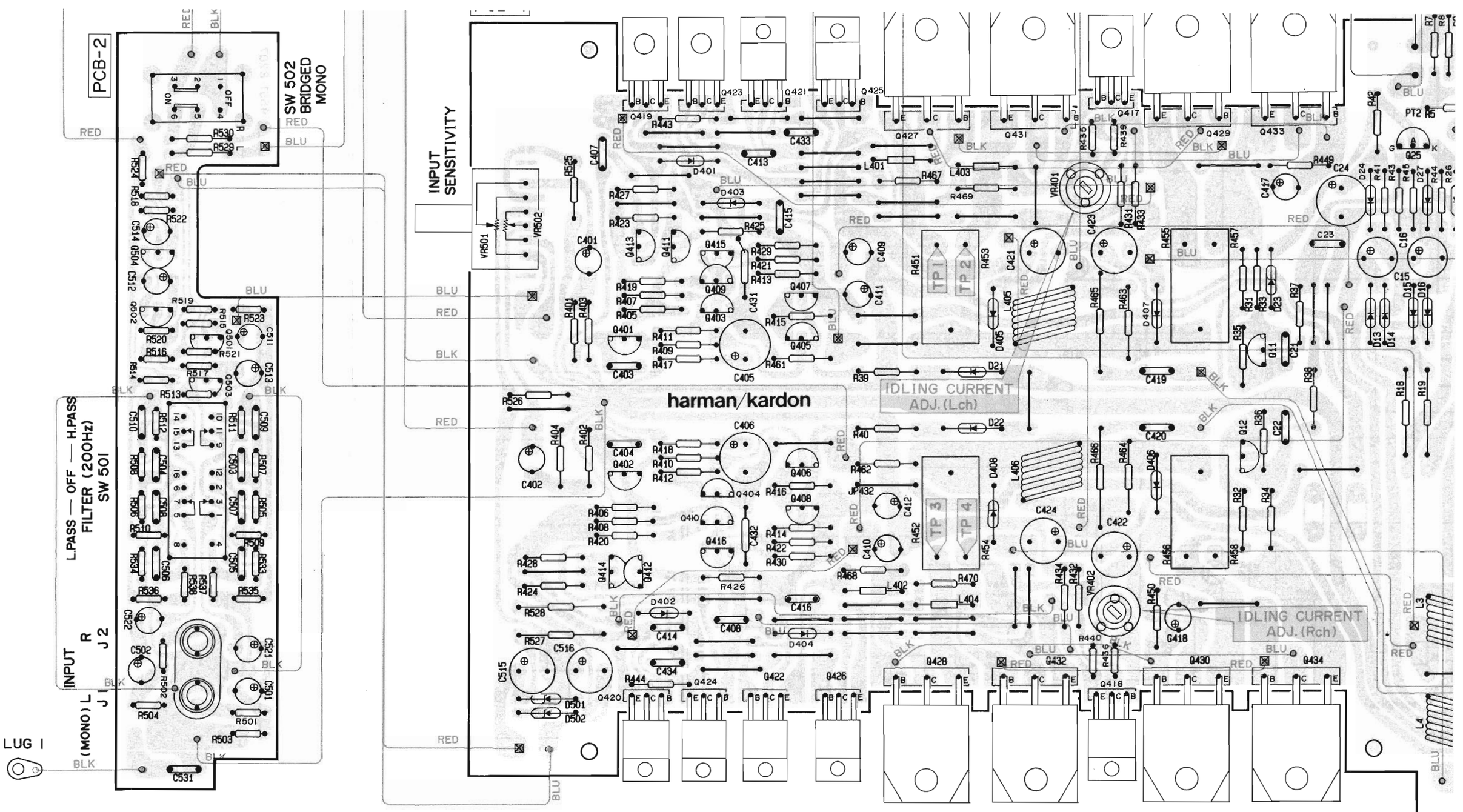
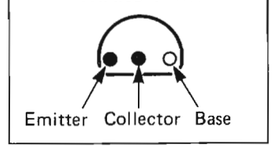


TRANSISTOR



PIN CONNECTION DIAGRAM OF TRANSISTORS, DIODES AND ICS.

2SC2240 2SA999L 2SC2320L 2SA992	2SC2603	2SD669 2SB649	2SB646 2SD666 2SA1286 2SC3246	2SC3345 2SC2591 2SA1111	2SC2626 2SC3181	2SA1264	1S2473 HZ9A-2L 10DF2 HZ12B2L 1S2471 ERC102FL HZ6B-2L	CR02AM-4	GL5HD10	PB101F	MN4011B

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IDLING CURRENT ADJ. (Lch)

IDLING CURRENT ADJ. (Rch)

TI POWER

S AND ICS.

2SB646 2SD666 2SA1286 2SC3246	2SC3345 2SC2591 2SA1111	2SC2626 2SC3181	2SA1264	1S2473 HZ9A-2L 10DF2 HZ12B2L 1S2471 ERC102FL HZ6B-2L	CR02AM-4	GL5HD10 Cathode Anode	PB101F	MN4011B

- WIRE COLOR ABBREVIATIONS
  - RED : Red
  - ORG : Orange
  - BLU : Blue
  - WHT : White
  - GRN : Green
  - BLK : Black
  - YEL : Yellow
  - PUP : Purple
  - PIK : Pink