

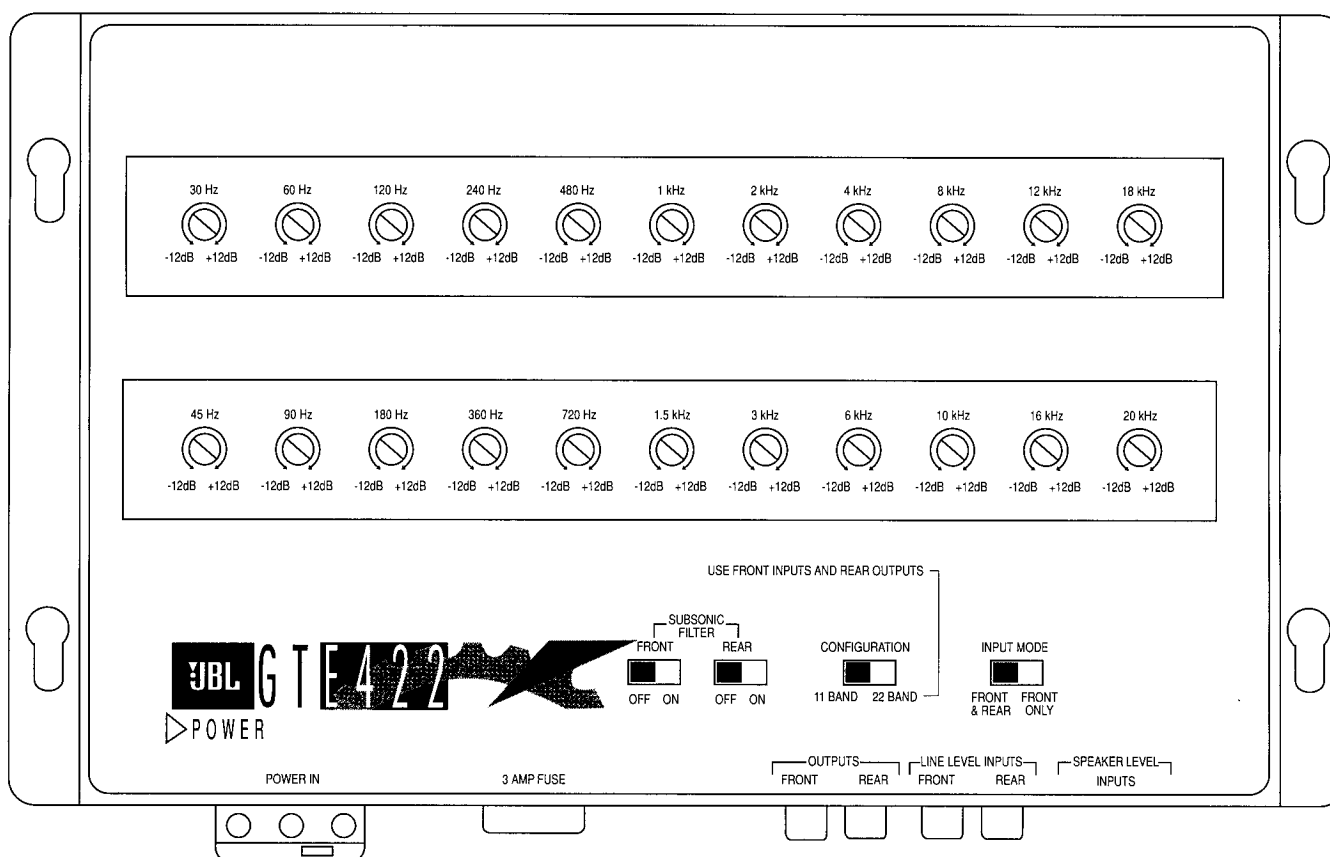
GTE422

22/11 BAND

CONFIGURABLE

EQUALIZER

TECHNICAL MANUAL



JBL Consumer Products Inc.
 80 Crossways Park West
 Woodbury, N.Y. 11797
 1-800-336-4JBL in the USA

H A Harman International Company

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GTE422 Specifications

Number of Bands:	4 Channel 11-Band Equalizer or 2 Channel 22-Band Equalizer
Front Equalizer Center Frequencies: (20%)	45 Hz, 90 Hz, 180 Hz, 360 Hz, 720 Hz, 1.5 kHz, 3 kHz, 6 kHz, 10 kHz, 16 kHz, 20 kHz.
Rear Equalizer Center Frequencies: (20%)	30 Hz, 60 Hz, 120 Hz, 240 Hz, 480 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, 12 kHz, 18 Khz.
Boost and Cut Range:	±12 dB
Subsonic Filter:	10 Hz, 12 dB/octave
Signal to Noise Ratio:	100 dBA
Frequency Response (all controls flat):	10 Hz - 80,000 Hz (0+, -1 dB)
THD:	0.04%
Maximum Line Level Input and Output:	5 vrms
Maximum Speaker Level Input:	7 vrms
Input Impedance:	15 kΩ
Fuse:	3 Amp ATO type
Output Impedance:	100Ω
Dimensions:	7 1/8" x 11 7/8" x 1 5/8" (180mm x 300mm x 41mm)
Weight:	3.5 lbs. (1.6 kg)

Theory of Operation

Equalization, a form of signal processing, is used to alter the frequency response of a system in order to:

- **Compensate for the effects of a system's enclosure** (the vehicle's interior in this case): The shape and material of an enclosure can absorb (attenuate) some frequencies and boost others. Typical examples are absorption of high frequencies by the cloth interiors and magnification of 100-250 Hz due to resonance of the vehicle's interior. These factors can alter the actual frequency response of an excellent sound system and introduce a variety of non-linearities in its acoustical response.
- **Compensate for the effects of the environment surrounding the sound system:** sources external to the vehicle such as road noise in a moving car can mask out lower frequencies and reduce their audibility.
- **Compensate for the non-linearities of the sound system:** some signal sources (head units) and speakers have non-ideal frequency response characteristics. This problem becomes even more prevalent when passive crossovers are used; reactance of the passive components creates many peaks and dips in the response characteristics.
- **Compensate for deficiencies in source material:** a marginal CD or cassette recording can be immensely improved by equalization. Furthermore, the listener's personal tastes can also be addressed (such as emphasized high and low frequencies).
- The first three items; Compensation for system enclosure, system environment and the system itself are completely objective.
- User tastes and preferences do not play a part in these categories. Therefore, it is best to leave these adjustments and compensations to the professional installation technician or systems engineer at the time of installation. For this purpose a very precise trunk-mounted equalizer such as the GTE422 is the best solution. It allows very accurate adjustment of all equalization parameters and minimizes the chance of accidental tampering.
- For source material frequency compensation, an in dash, user adjustable equalizer should be used, a different source software will require different frequency adjustment. The GTE422 is intended for use in setting up a desired frequency response curve and then leaving it.

Control and Switches

Notes on the input Mode and Configuration switches:

A 4 Input, 4 Output Operation:

Input mode: Front and Rear, Configuration: 11 Band - Allows connection of separate front and rear outputs of a signal source to front and rear inputs of the GTE422. In this mode, the GTE 422 acts as two completely independent front and rear equalizers. This system combination allows fading between front and rear channels from the head of the unit.

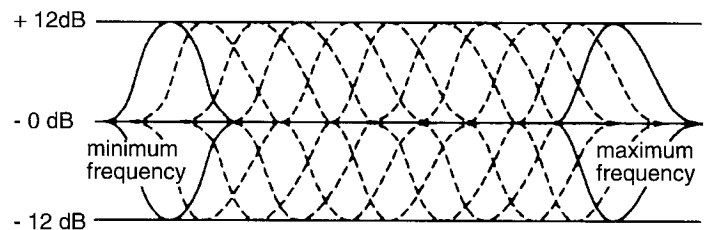
B. 2 Channel Input-11 Band, 4-Channel output operation:

Input mode: Front only, Configuration: 11 Band - Allows connection of a head unit with a single pre-amp output to the front input of the GTE422. This signal is then routed to front and rear equalizers of the unit, independently equalized and sent to the separate front and rear output terminals of the GTE422. In this setup, the rear input is disabled, and there will be no fading capability. This, however, allows for different equalization curves to be selected for front and rear channels.

C. 2 Channel - 22-Band operation:

Input mode: Front only, Configuration: 22 Band - Configures the GTE422 into a 2 channel, 22-band equalizer, providing tremendous system adjustment capability utilizing a total of twenty-two fully adjustable bands devoted to two channels. If this mode of operation is desired, a second GTE422 will be necessary for a front/rear system.

1. FRONT AND REAR CHANNEL EQUALIZER CONTROLS:



These controls boost or attenuate the frequency as marked. Note that the front and rear Channel center frequencies are staggered for use as a 22-band equalizer when the unit is in the 22-band mode.

2. POWER LED INDICATOR

This indicator lights when the unit is powered up and operational.

3. SUBSONIC FILTER CONTROL:

These controls engage a subsonic filter that eliminates frequencies below 10 Hz.

4. CONFIGURATION SWITCH:

The configuration switch connects the front and rear equalizer sections to create either a 4-channel 11-band equalizer or a 2-channel 22-band equalizer.

5. INPUT MODE SWITCH:

In front only mode - the equalizer will accept 2-channel input (on the front channel) and will deliver 4-channel or 2 channel output depending on the configuration switch setting. In Front and Rear mode - the equalizer will accept 4-channel input and will produce 4-channel output.

6. POWER CONNECTOR:

Connect Battery +, Ground and CD/Cassette Remote on/off line to this connector. (see Connection Diagram on page 4).

7. FUSE:

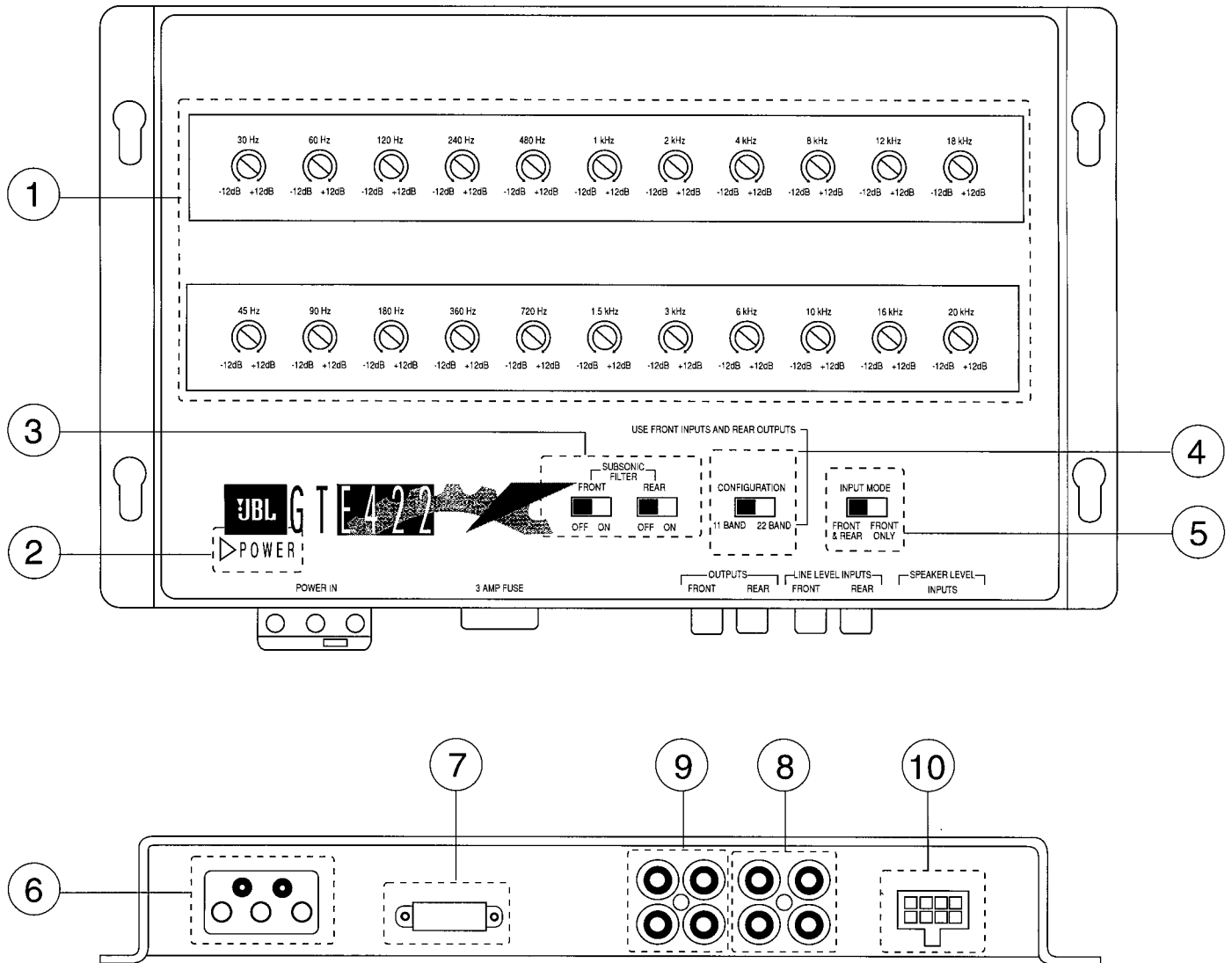
3 amp ATO type fuse.

8. INPUT RCA CONNECTORS

9. OUTPUT RCA CONNECTORS

10. SPEAKER INPUT CONNECTORS:

Input which can accept speaker level connection from CD/Cassette players which do not have line level outputs.



Installation Instructions

Power Wiring Connections:

Please refer to the diagrams on pages 4 and 5 for wiring connections.

The power supply wires for the GTE422 are to be connected to the power supply terminals that extend from the front of the chassis.

Keep the power wires as short as possible. If they must be run outside the passenger and trunk compartments, use heat and chemical resistant automotive wire. Be sure the wire connections are strong and well insulated.

Battery (+) 12 volt power input -

Connect a wire from this terminal directly to the battery's positive (+) terminal. Be sure to use an additional in-line fuse holder with a 3 A fast blow fuse, as close as possible to the battery's positive (+) terminal. Use 12-gauge wire for the power wire.

Audio Connections

The signal voltage levels and impedance of the inputs of the GTE422 are compatible with virtually all signal sources that feature preamp (line) and speaker level outputs.

Preamp Level Connections -

Connect the audio input and output RCA connectors as shown in the diagrams on page 5. The connections to and from the GTE422 should be made with high quality shielded cables terminated with standard RCA connectors. These cables should be kept as short as possible and should not be run next to power or other vehicle wiring in order to minimize the chance of noise being picked up. Never attempt to splice together shielded wires.

Battery ground -

Proper grounding is extremely important. It has a significant effect on the overall performance and noise level of the system. This wire should be connected to a

solid electrical ground point on the frame of the vehicle or somewhere in the electrical system. If the ground wire is connected to a part of the vehicle frame that is painted, scrape off the paint and primer to ensure a good ground connection. For best results, all audio components should be connected to a common point on the chassis.

Remote Turn-on -

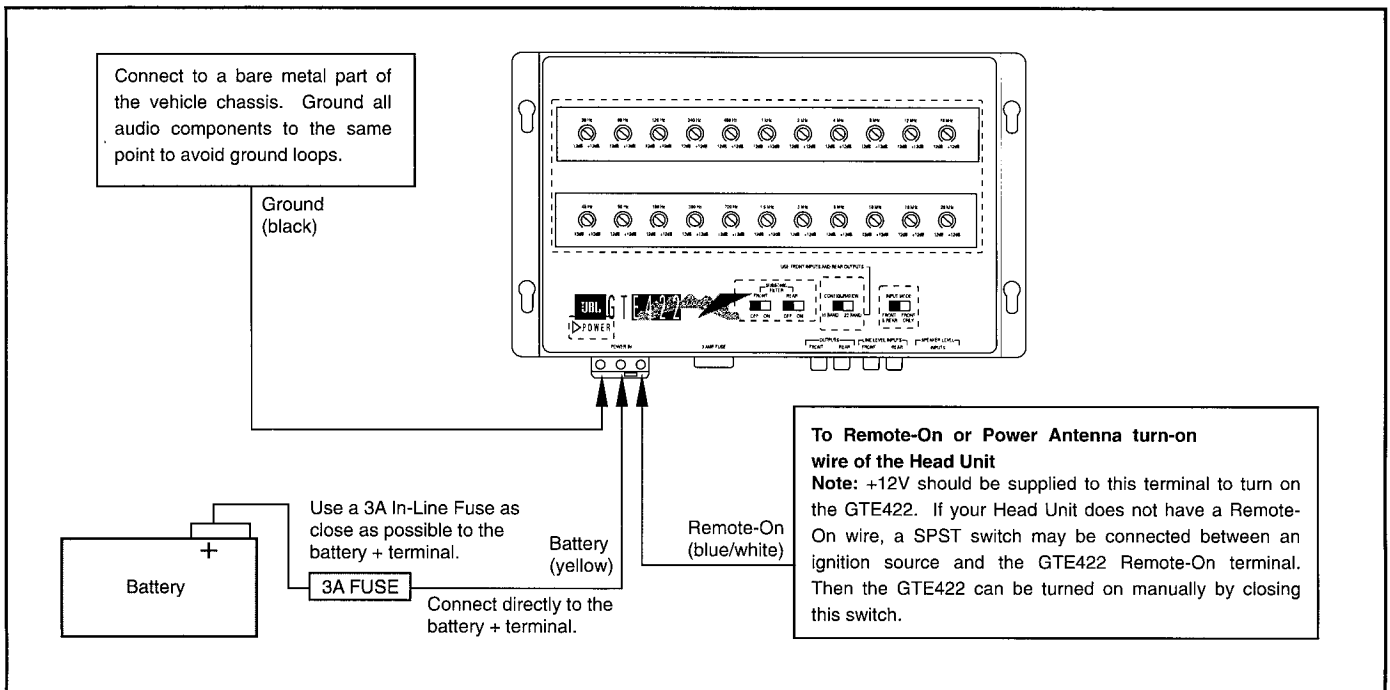
Connect this wire to a +12 volt source that is turned on and off with the system. Most head units have a "remote on" or "power antenna" wire that can be used for this connection. Alternatively, the Remote on wire can be connected to a +12 volt source that is turned on and off with the accessory system of the vehicle.

Speaker Level Inputs -

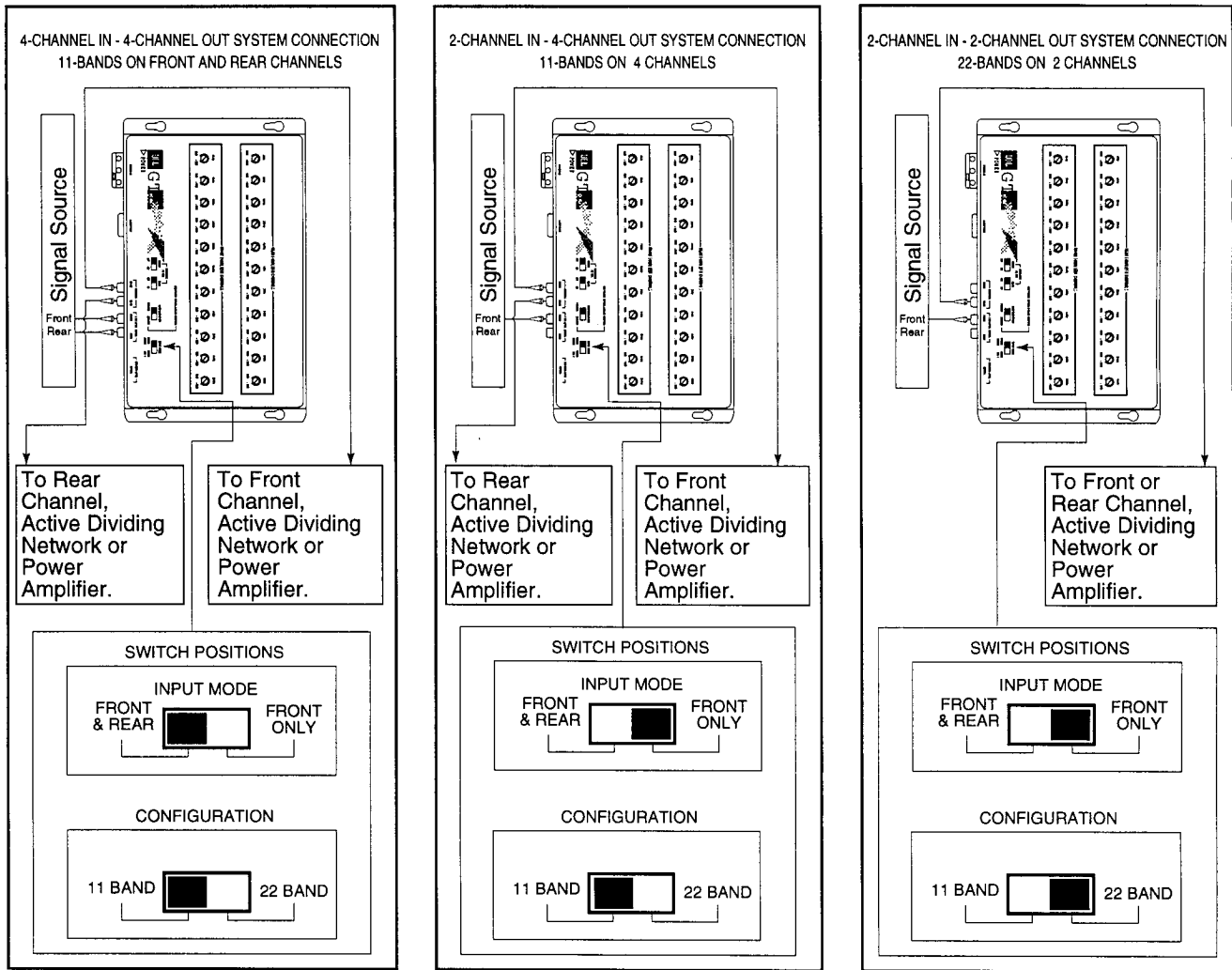
When the high level (speaker level) outputs of a cassette/CD are used to drive the GTE422, the signal goes into the GTE422 through a special 8 wire harness and connector (included). If extension wires must be used to connect the speaker output from the cassette/CD player to the GTE422 high (speaker) level inputs use 18 gauge speaker wire. Keep such extension wires as short as is practical and do not run them outside the passenger and trunk compartments. Use the color code of the input wire harness and the cassette/CD player output wires to be sure the left/right channel orientation and the positive/negative orientation, of each connection is correct. For example, the left positive output of the cassette/CD player must be connected to the left positive input of the GTE422. The color code for the high level input wire harness is:

Left Front +	White
Left Front -	White/Black
Right Front +	Gray
Right Front -	Gray/Black
Left Rear +	Green
Left Rear -	Green/Black
Right Rear +	Purple
Right Rear -	Purple/Black

Connection Diagram



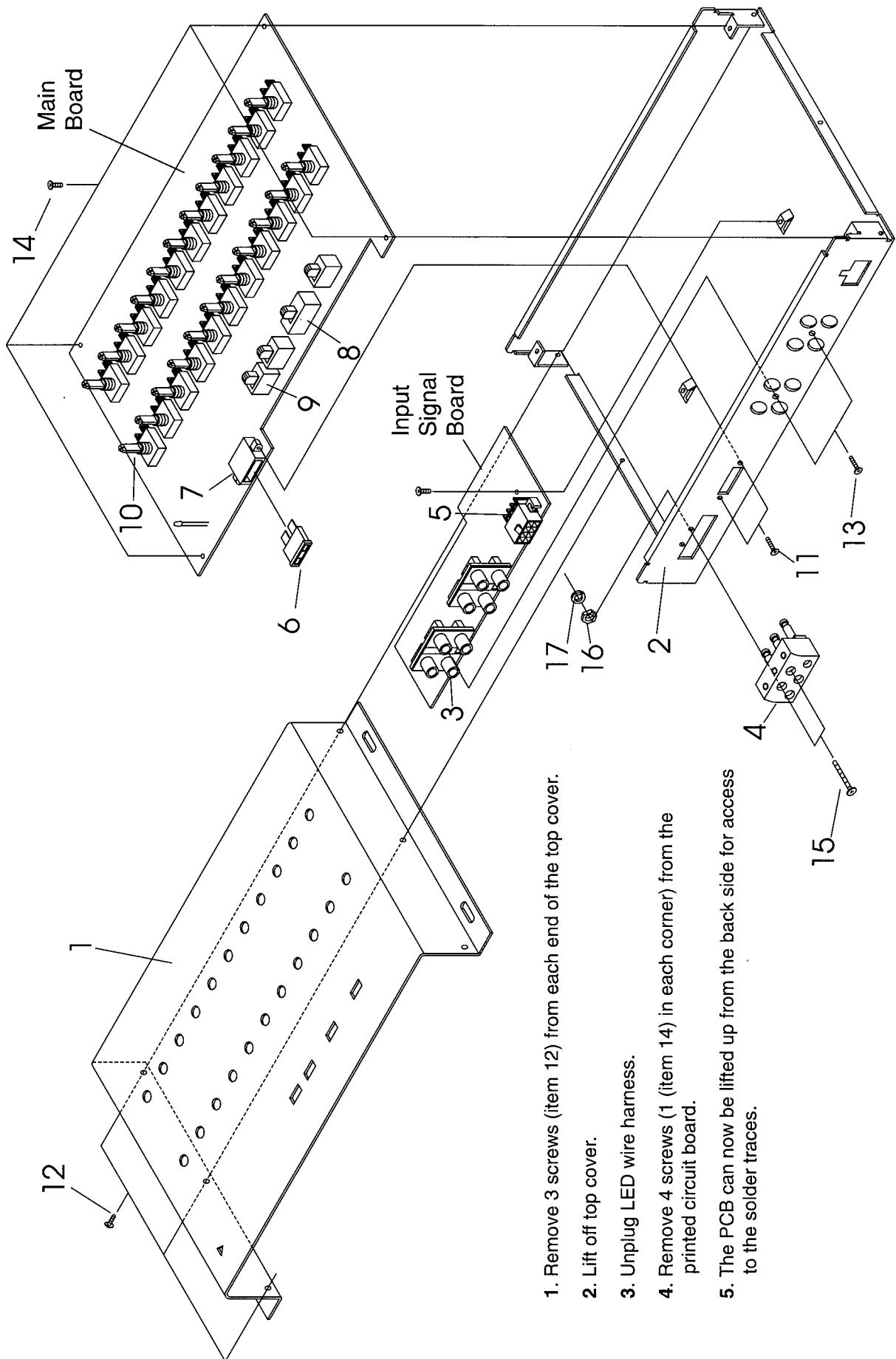
System Chart



Mechanical Parts List

Reference Number	Part Number	Description	Quantity	
1	5-01-095	2267-1 TOP COVER	1	
2	5-01-096	2267-2 BOTTOM COVER	1	
3	1-44-407	4RCA JACK HSP-204V-03 GOLD	2	
4	3-61-025	POWER TERMINAL ASSEMBLY	1	
5	WAFER	1-58-004	8POLE MOLE#5569-08AI CONNECTOR	1
6	FUSE	1-29-111	GM FUSE LAMP 3A	1
7		1-29-130	GM FUSE HOLDER 1800F1	1
8	SWITCH	1-27-039	SL.SW.SS-42F01G4	1
9		1-27-038	SL.SW.SS-22F48 G4/SS-22F16G4	3
10	VR	1-26-096	RK141230 50KW2 15mm w/o C.C	22
11	S & W	1-33-061	2.6X0.45X6 BM NI SCREW	2
12		1-33-251	3X0.5X5 (2.6) BM NI SCREW	6
13		1-33-252	3X8 (2.6) BT NI SCREW	2
14		1-35-305	3X0.5X6 BM NI SCREW	6
15		1-35-379	3X0.5X16 BM NI SCREW	2
16		1-37-130	M3 NUT	2
17		1-37-230	M3 SPRING WASHER ZNC	2

Mechanical Exploded View



1. Remove 3 screws (item 12) from each end of the top cover.
2. Lift off top cover.
3. Unplug LED wire harness.
4. Remove 4 screws (1 (item 14) in each corner) from the printed circuit board.
5. The PCB can now be lifted up from the back side for access to the solder traces.

Electrical Parts List

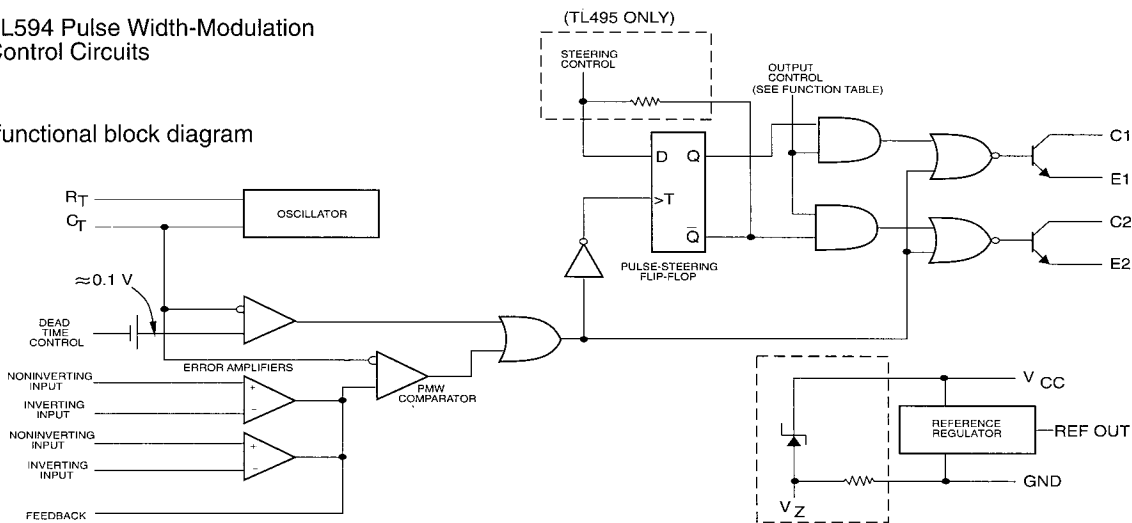
Reference Number	Part Number	Description	Quantity
LED BOARD			
LED			
D 10	1-25-011	TRI-LED RED 5X4 SIL-2233D	1
INPUT SIGNAL BOARD			
ELECTROLYTIC CAPACITORS			
C 3, 43, 52, 91, 94, 130, 134, 173, 177	1-13110LH	16V+-10% 10UF	9
C 4, 54, 95, 135	1-16147PH	50V+-10% 470PF	4
RESISTORS			
R 7, 27, 47, 67, 85, 86 87, 88	1-17-210	1/8W+-5% PS 100 OHM	8
R 20, 40, 46, 60, 66, 80	1-17-510	1/8W+-5% PS 10K OHM	6
R 8, 28, 48, 68	1-17-510	1/8W+-5% PS 100K OHM	4
R 81, 82, 83, 84	1-23-115	5W+-5% PS 15 OHM	4
MAIN BOARD			
CHOKES			
	1-01-204	COIL ASSEMBLY (TOROID XJ-41306)	1
BOARD			
COIL			
	1-05-205	0.6X120T 600uH T68-26	1
DIODES			
D 2	1-05-001	IN4001	1
D 1	1-05-009	IN4148	1
D 4,,5,6,7	1-05-022	FR152 BL	4
ZENER DIODES			
D 3	1-06-005	1/2W 15V ±5%	1
D 8,9	1-06-107	1/2 W 12V ±5%	2
TRANSISTORS			
Q 1,2	1-07-003	9013H "ARRAY NEC"	2
Q 4	1-08-150	BD139 SGS	1
Q 3	1-08-155	BD140 SGS	1
INTEGRATED CIRCUITS			
IC 3,4,7,10,14,15	1-09-002	M5229P "MITSUBISHI"	7
IC 1,2,5,6,8,9,11,12	1-09-406	JRC 353D/LF353NS	8
IC 16	1-09-418	TL594CN TI	1
MYLAR CAPACITORS			
C 20,31,50,70,176	1-10310RH	100V ±10% 0.01uF	5
C 32,82,125,165	1-10312RH	100V ±10% 0.012uF	4
C 18,68,112,122,152,162	1-10318RH	100V ±10% 0.018uF	6
C 29,79	1-10322RH	100V ±10% 0.022uF	2
C 15,65,109,120,149,160	1-10333RH	100V ±10% 0.033uF	6
C 25,76	1-10347RH	100V ±10% 0.047uF	2
C 107,147	1-10356RH	100V ±10% 0.056uF	2
C 118,158	1-10368RH	100V ±10% 0.068uF	2
C 12,24,62,74	1-10382RH	100V ±10% 0.082uF	4
C 48,49,121,161	1-10410RH	100V ±10% 0.0010uF	4
C 27,77	1-10412RH	100V ±10% 0.0012uF	2
C 119,159	1-10418RH	100V ±10% 0.0018uF	2
C 25, 75	1-10427RH	100V ±10% 0.0027uF	2
C 117,157	1-10435RH	100V ±10% 0.0033uF	2
C 23,73,175	1-10447RH	100V ±10% 0.0047uF	3
C 38,88,128,168	1-10456RH	100V ±10% 0.056uF	4
C 16,66,114,154	1-10468RH	100V ±10% 0.0068uF	4
C 35,85	1-10482RH	100V ±10% 0.0082uF	2

Reference Number	Part Number	Description	Quantity
ELECTROLYTIC CAPACITORS			
C 78,81,166	1-12210LI	16V ±20% 100uF	3
C 124,143	1-12247LI	16V ±20% 470uF	2
C 28	1-12522NI	35V ±20% 2200uF	1
C 1,2,6,7,8,51,53,56,57 58,92,93,97,98,99,103 110,132,133,137,138,139	1-13110LH	16V ±10% 10uF	22
C 174	1-13133LI	16V ±20% 33uF	1
C 13,47,63,105,108,145,148	1-13010PH	50V ±10% 1uF	7
C 104,116,144,156	1-13301PH	50V ±10% 0.12uF	4
C 10, 22,60 72	1-13018PH	50V ±10% 0.18uF	4
C 14,64,113,153	1-13002PH	50V ±10% 0.22uF	4
C 101,141	1-13003PH	50V ±10% 0.27uF	2
C 19,69	1-13007PH	50V ±10% 0.39uF	2
C 111, 151	1-13004PH	50V ±10% 0.47uF	2
C 17, 67	1-13006PH	50V ±10% 0.68uF	2
C 106, 146	1-13008PH	50V ±10% 0.82uF	2
C 11, 61	1-13022PH	50V ±10% 2.2uF	2
C 102, 142	1-13033PH	50V ±10% 3.3uF	2
C 41,42,89,90,129 131,171,172	1-13047PH	50V ±10% 4.7uF	8
MONOLITHIC CAPACITORS			
C 39,40,44,45,46,126, 150,164,169,170	1-14091PH	50V ±10% 0.1uF (ECO5ZD104KHB)	10
CERAMIC CAPACITOR			
C 5, 55, 96, 136	1-16030PH	50V+-10% 30P	4
C 37, 87	1-16047PH	50V+-10% 47P	2
C 34, 84	1-16110PH	50V+-10% 100P	2
C 33, 83	1-16130PH	50V+-10% 300P	2
C 36, 86	1-16133PH	50V+-10% 330P	2
C 9, 59, 100, 115, 127, 140, 155, 167	1-16147PH	50V+-10% 470P	8
C 21, 71, 123, 163	1-16168PH	50V+-10% 680P	4
C 30, 80	1-16182PH	50V+-10% 820P	2
RESISTORS			
R 9,29,49,69	1-17-310	1/8W+-5% PS 1K OHM	4
R 16, 36, 56, 76	1-17-327	1/8W+-5% PS 2.7OHM	4
R 13, 14, 33, 53, 54, 73, 74	1-17-333	1/8W+-5% PS 3.3K OHM	8
R 1, 2, 3, 4, 5, 6, 10, 15, 21, 22, 23, 24, 25, 26, 30, 35, 41, 42, 43, 44, 45, 50, 55, 61, 62, 63, 64, 65, 70, 75	1-17-430	1/8W+-5% PS 30K OHM	30
R 11, 31, 51, 71	1-17-430	1/8W+-5% PS 30K OHM	4
R 12, 32, 52, 72	1-17-447	1/8W+-5% PS 47K OHM	4
R 18, 38, 58, 78	1-17-511	1/8W+-5% PS 110K OHM	4
R 19, 39, 59, 79	1-17-524	1/8W+-5% PS 240K OHM	4
R 17, 37, 57, 77, 110, 111, 112, 113	1-17-256	1/8W+-5% PS 560 OHM	8
R 90	1-18-110	1/4W+-5% PS 10 OH	1
R 91, 94, 95, 99, 101, 105 106, 109	1-18-310	1/4W+-5% PS 1K OHM	8
R 107, 108	1-18-322	1/4W+-5% PS 2.2K OHM	2
R 96	1-18-347	1/4W+-5% PS 4.7 OHM	1
R100	1-18-362	1/4W+-5% PS 6.2 OHM	1
R 97,104	1-18-410	1/4W+-5% PS 10K OHM	2
R 93	1-18-412	1/4W+-5% PS 22K OHM	1
R 89,98	1-18-447	1/4W+-5% PS 47K OHM	2
R 102, 103	1-19-050	1/2W+-5% PS 5 OHM	2

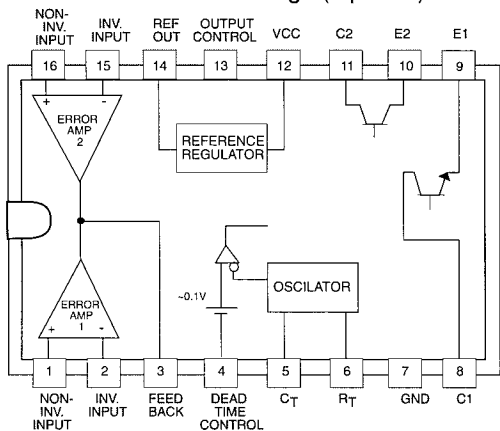
Intergrated Circuit Layout and Voltages

TL594 Pulse Width-Modulation Control Circuits

functional block diagram



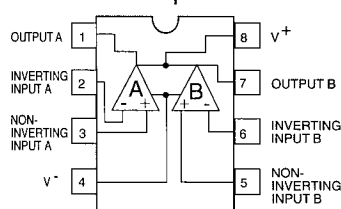
TL594 Dual In-Line Package (top view)



I C: 16 (TL 594)

PIN	VOLTAGE	PIN	VOLTAGE
1	7 mV	9	1.3 V
2	3 V	10	1.3 V
3	62 mV	11	10.3 V
4	36.6 mV	12	13.5 V
5	1.5 V	13	5 V
6	3.5 V	14	5 V
7	7.5 mV	15	4.3 V
8	8.6 V	16	3 V

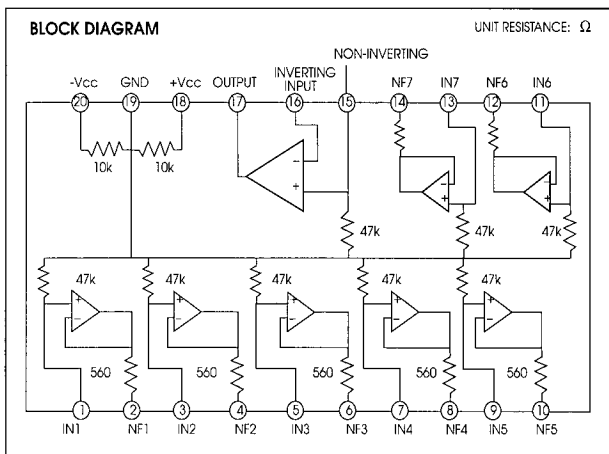
LF353 top view



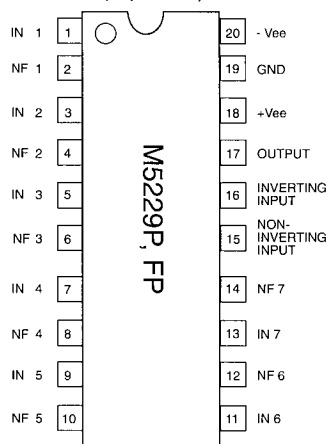
I C: 1, 2, 5, 6, 8, 9, 11, 12, (LF353)

PIN	VOLTAGE
1	2.6 mV
2	2.6 mV
3	7.1 mV
4	11.7 V
5	7.1 mV
6	3.5 mV
7	3.5 mV
8	11.4 V

M5229P, FP Hi-Fi 7-Element Graphic Equalzer IC



Pin Configuration (top view)

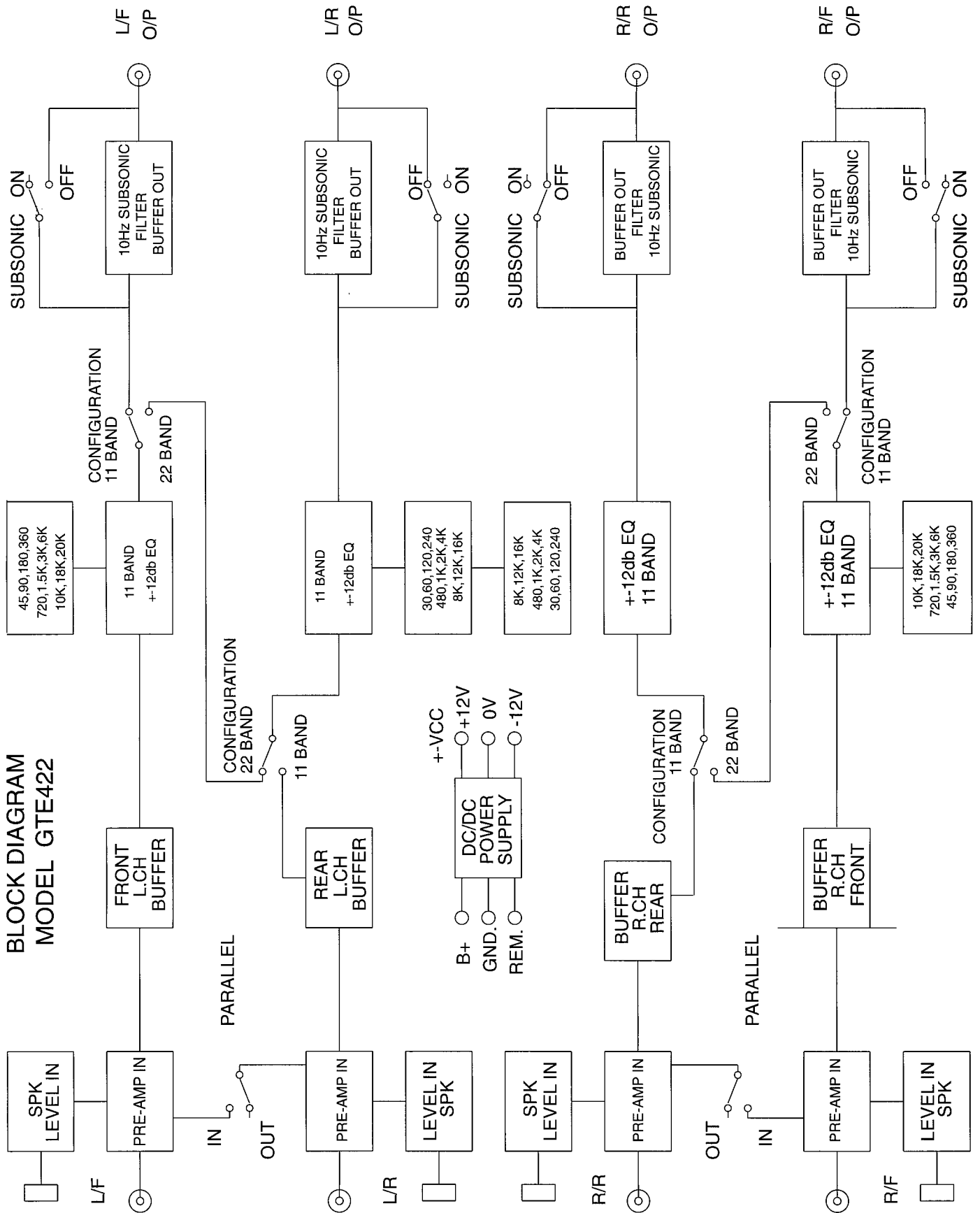


Outline 20P4 (P) 20 P2(FP)
Note: Voltages given are for no audio input with +12v applied to Rem In and + battery terminals with ground connected.

I C: 3, 4, 7, 10, 13, 14, 15 (M5229P)

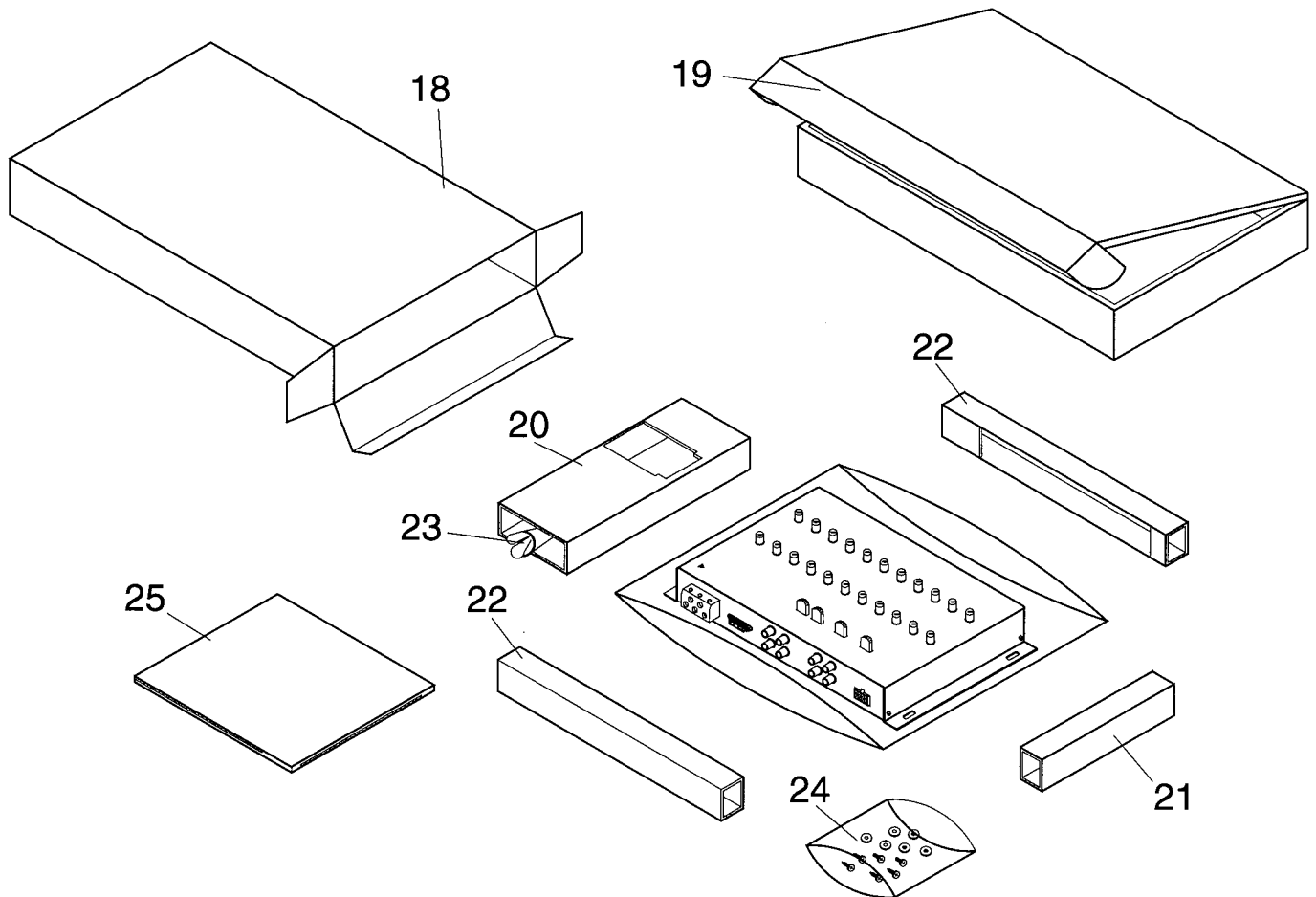
PIN	VOLTAGE	PIN	VOLTAGE
1	9 mV	11	9 mV
2	9 mV	12	10 mV
3	9 mV	13	9 mV
4	9 mV	14	10 mV
5	9 mV	15	2.6 mV
6	9 mV	16	1.5 mV
7	9 mV	17	.5 mV
8	10 mV	18	11.4 V
9	9 mV	19	7.2 mV
10	10 mV	20	11.7 V

Block Diagram



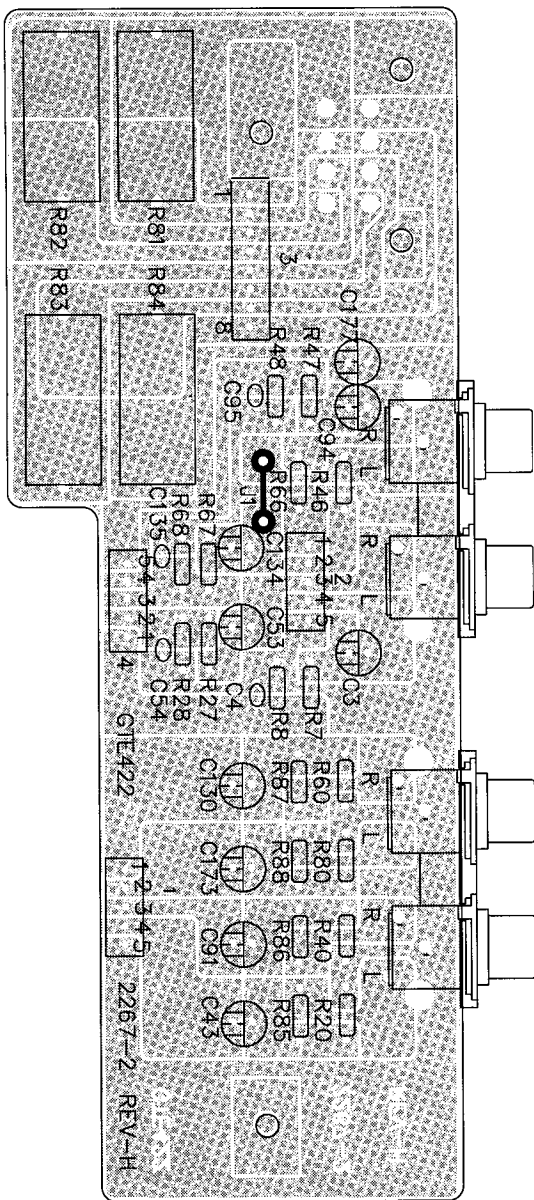
Packaging Parts List

Reference Number	Part Number	Description	Quantity
18	2267-1	GIFT BOX GTE422	1
19	2267-2	INNER BOX P1	1
20	2267-3	INNER PAD P2	1
21	2267-4	INNER PAD P3	1
22	2267-5	INNER PAD P5	2
SPEAKER LEVEL INPUT HARNESS			
23	1-50-047	MOLEX 8 POLE #3901-01-2080 SET	1
FUSE			
24-1	1-29-102	GM FUSE LAMP 3A	1
SCREWS & WASHERS			
24-2	1-36-431	4X19 PA BZ	4
24-3	1-37-140	M4 FLAT WASHER BZ	4
24-5	1-37-240	M4 FLAT SPRING WASHER BZ	4
25	2267-6	MANUAL	1

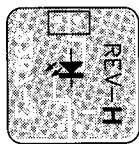


GTE422 Printed Circuit Boards

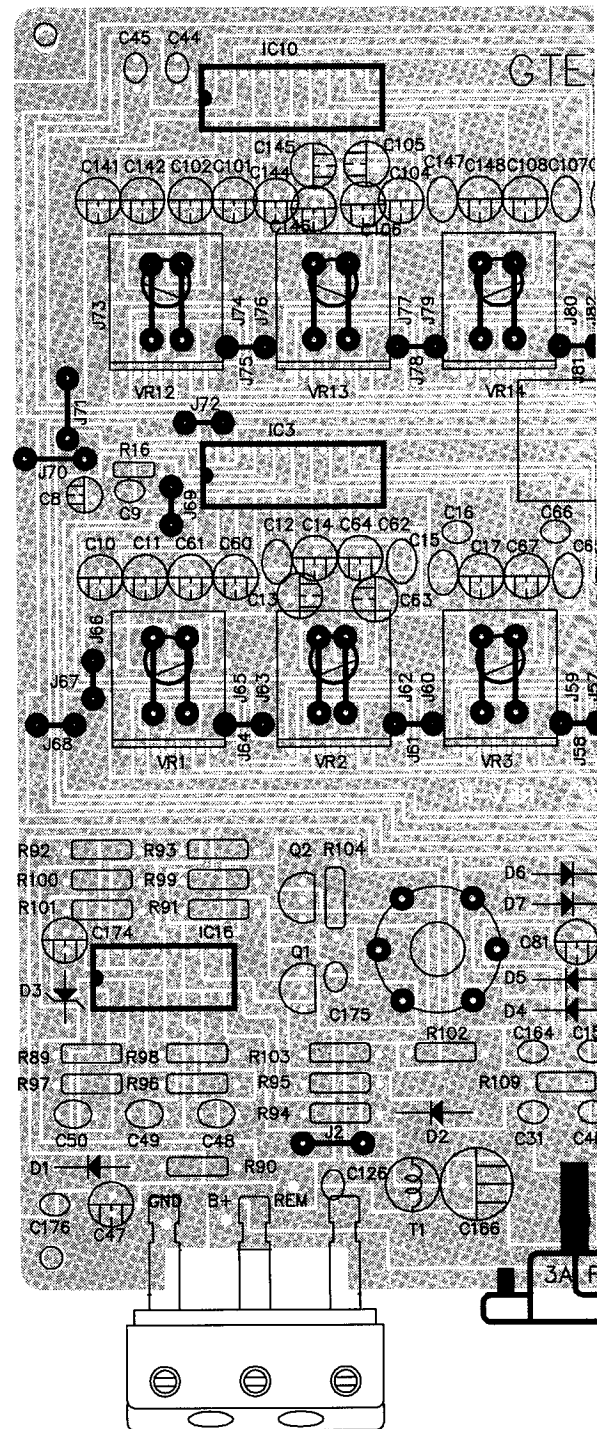
INPUT SIGNAL BOARD



LED BOARD



MAIN BOARD



F

G

H

I

J

1

2

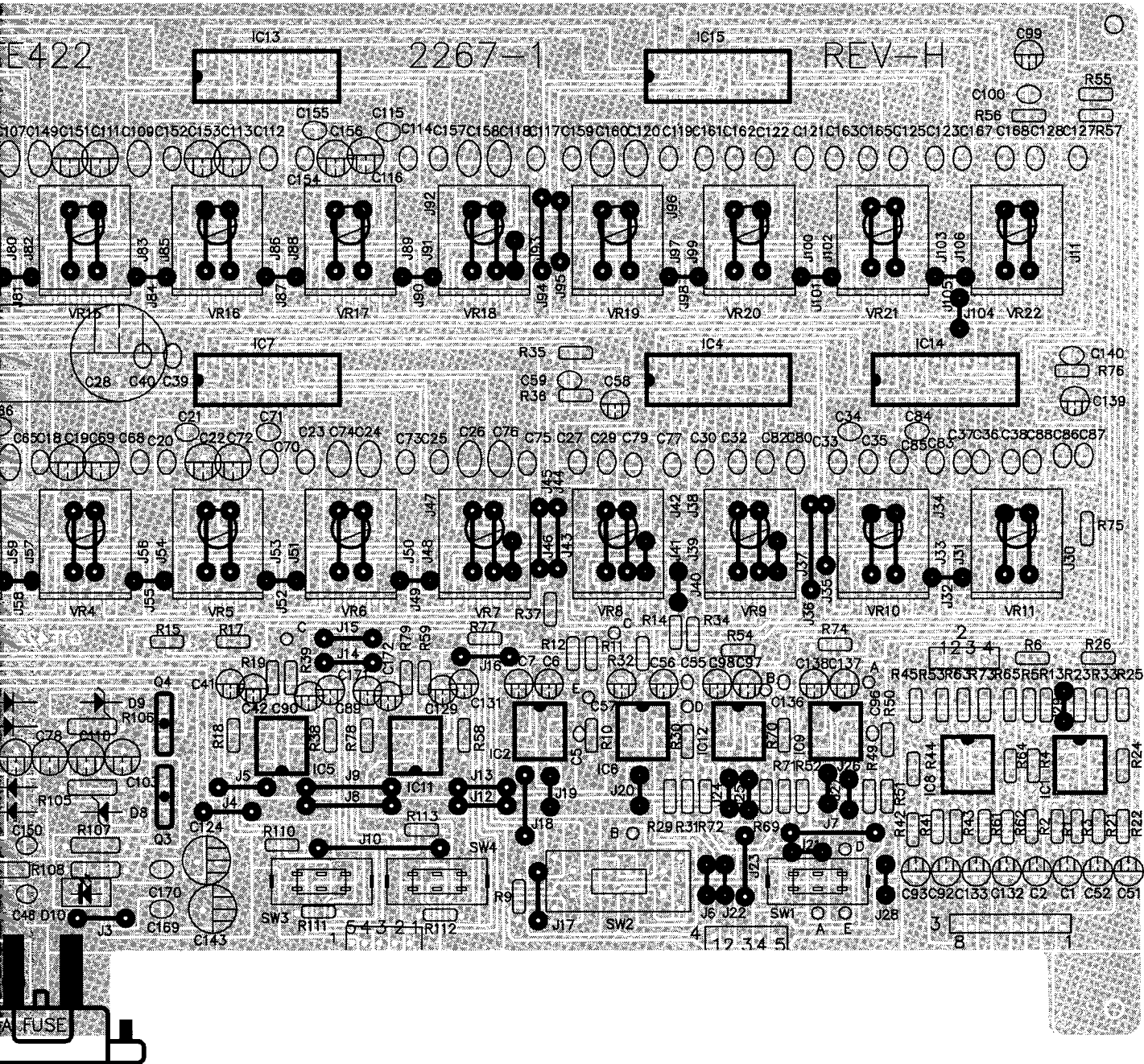
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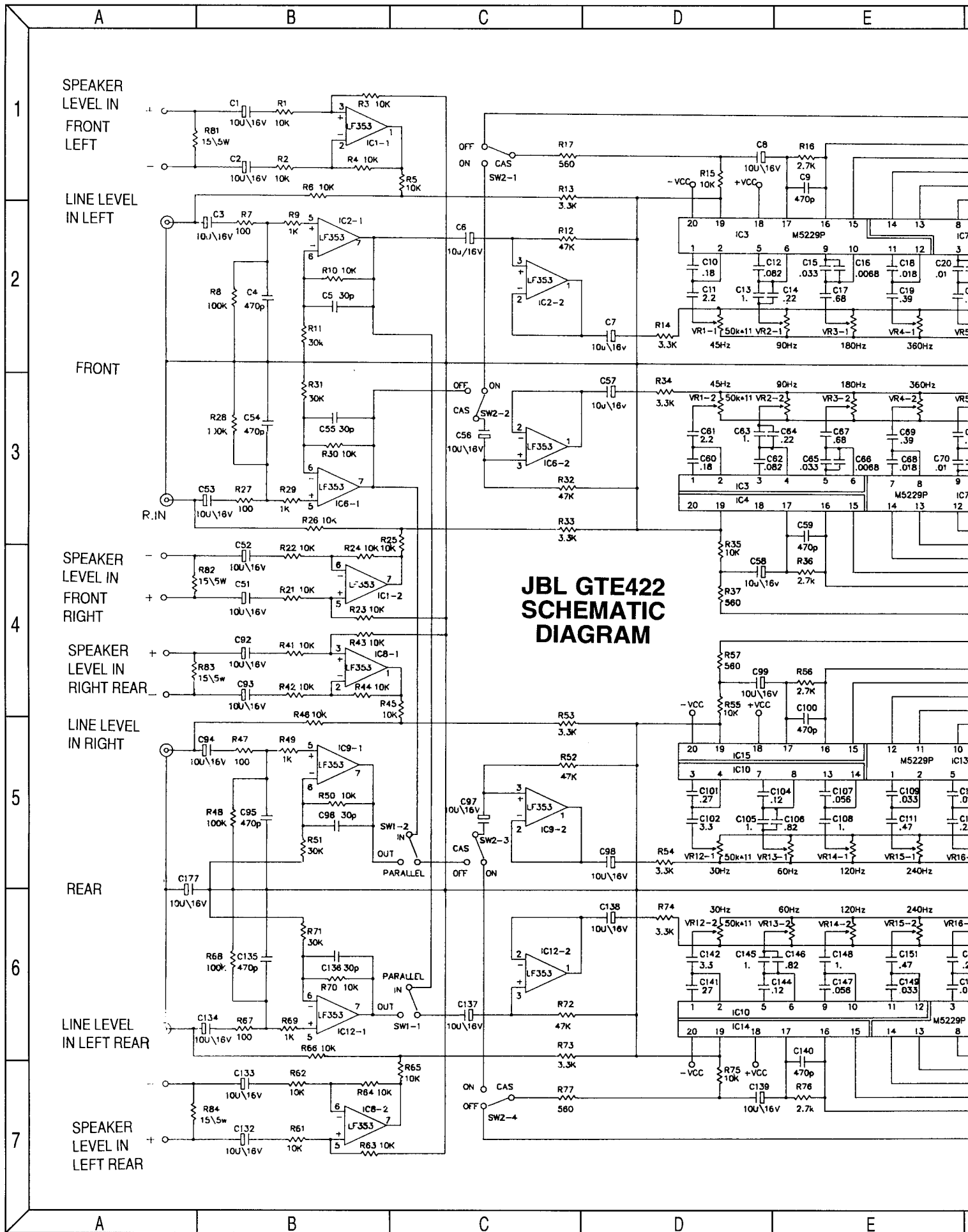
F

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**JBL GTE422
SCHEMATIC
DIAGRAM**

