

# **AV210**

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# **SERVICE MANUAL**

***BBK***

BBK ELECTRONICS CORP., LTD.

***BBK***

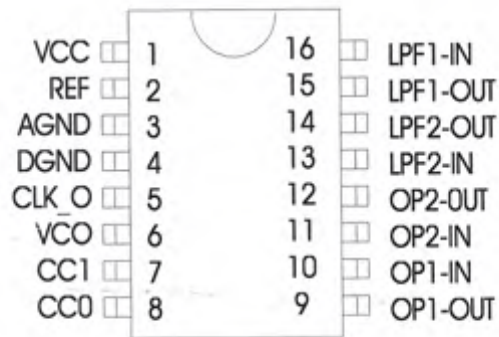
DESCRIPTION

PT2399 is an echo audio processor IC utilizing CMOS Technology which is equipped with ADC and DAC, high sampling frequency and an internal memory of 44K. Digital processing is used to generate the delay time, it also features an internal VCO circuit in the system clock, thereby, making the frequency easily adjustable. PT2399 boast of very low distortion (THD<0.5%) and very low noise (No<-90dBV), thus producing high quality audio output. The pin assignments and application circuit are optimized for easy PCB layout and cost saving advantage.

FEATURES

- CMOS Technology
- Least External Components
- Auto Reset Function
- Low Noise, No<-90dBV Typical
- Low Distortion, THD<0.5% Typical
- External Adjustable VCO
- Available in 16 pins, DIP or SO package

PIN CONFIGURATION



PT2399

CAUTIONS



- There is high voltage inside this unit. Make sure to pull out the plug of this unit before repairing!
- There are many high voltage components inside this unit. Please pay attention to all warnings and instructions marked on this unit to avoid electric shock!
- Specifications of the replaced components must be the same as that of the original components. Do not change the components' specifications to prevent risks!

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| 24 | 24 |
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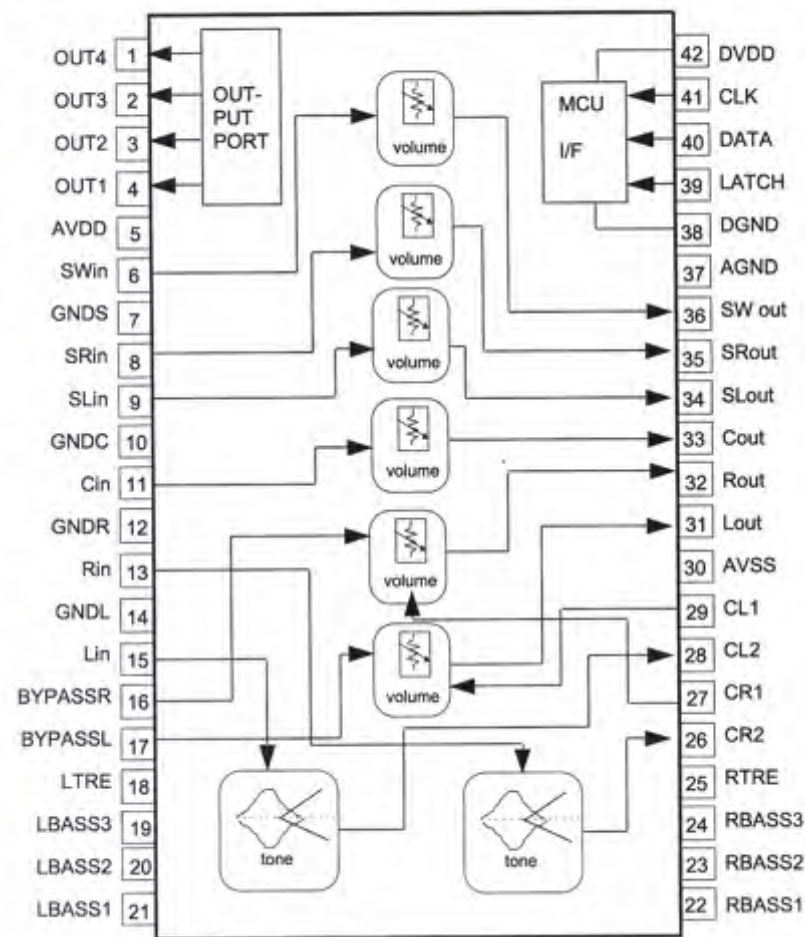
AV210 has three ways of the analog audio source input and one group of 5.1 channel input jacks. Their switch is realized by the electronic switch. The circuit incorporates two kinds of electronic switch IC: CD4052 (dual channel one out of four electronic analog switch) and Cd4053 (trio channel one out of two electronic analog switch). Their real value tables are as follows:

|   |    |    |    |    |
|---|----|----|----|----|
|   | X0 | X1 | X2 | X3 |
| A | 0  | 1  | 0  | 1  |
| B | 0  | 0  | 1  | 1  |

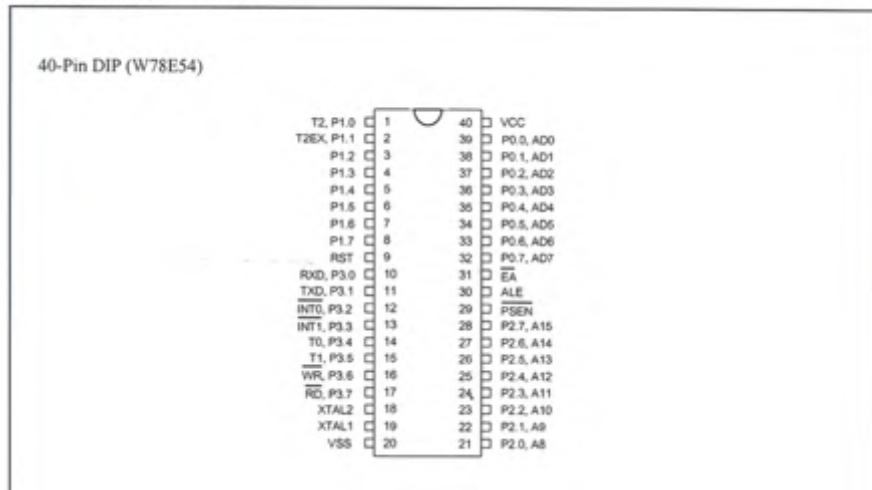
|   |    |   |    |   |    |
|---|----|---|----|---|----|
| A | X  | B | Y  | C | Z  |
| 0 | X0 | 0 | Y0 | 0 | Z0 |
| 1 | X1 | 1 | Y1 | 1 | Z1 |

1.1 5.1CH input mode: In this mode, A and B are high levels, L and R channel signals are sent out from the pins 3 & 13 of N401. Then the levels reach IC N402 to be master volume adjusted after amplified by N407A and N407B. At the same time, the pin 32 of CPU N422 sends out a high level to the electronic switch N410's pins 9, 10 and 11 (SEL control signal). C, SR and SL signals are sent out from the N410's pins 14, 15 and 4 to IC N402 where separate volumes are adjusted. SW signals (D-SW) is sent to the IC N402's where the volume is adjusted. Therefore, the 6 channel signals of 5.1 CH input are selected by the electronic switch and added into the electronic volume adjusting IC where the separate volume adjustment is performed. Then the signals pass to the rear circuit, the whole unit's input source is selected as 5.1CH input mode.

1.2.1 Standard StereoProcessing Mode: The L & R channelsignals from theN407A and N407B areadded to theIC N402 wherethe electronic volumeis adjusted. At the same time, a signal selected from the L channel passes N408Aand N406B wherethe signal is processedthrough low passfilter to obtain a subwoofer signal(S-SW). S-SW is added toN411'spin 5 and the pin 9(SEL) is lowlevel. Accordingto the realvalue table, S-SW signalis sent outfrom the pin4 to N402'spin 6 wherethe electronic volume is adjusted. In this mode, thisunit is in the three channel output mode.



## PIN CONFIGURATIONS



## volume control IC M62446

### DESCRIPTION

The M62446FP is 6 channels electric volume controlled 3-wire serial data. The IC is suitable for use in home-use audio systems and TV sets.

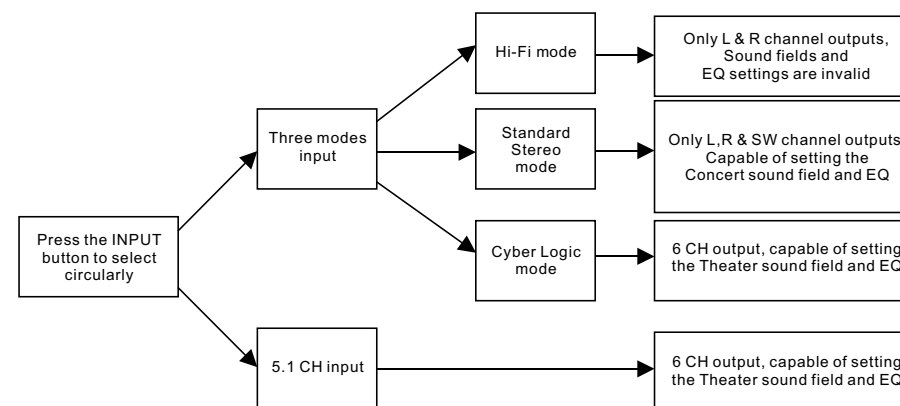
### FEATURES

- Electric volume
  - Volume level..... 0dB ~ -79dB, -∞dB (1dB / step)
- Tone control
  - Bass / Treble , 0dB ~ ±10dB(2dB / step)
- 4 Output ports
- Built-in microcomputer interface circuit controlled by 16-bit serial data.

1.2.1 Hi-Fi Processing Mode: The signal flow is the same as that of the standard stereo mode. The electronic volume adjusting IC N402 shut off other audio channels under the control of the CPU. Neither the sound fields processing and balance adjustment can be performed. Therefore, S-SW cannot be sent out and the whole unit is in the two channel output mode.

1.2.3 Cyber Logic: L&R channel signals sent out from N407A and N407B reach the IC N402 where the electronic master volume is adjusted. Meanwhile, the signals selected from the channel L passes through the low pass filter N408A where it is divided into two lines. One line reaches the pin 13 of N411 through R657 and another line reaches the pin 5 of N411 after it is amplified through the low pass filter N406B. The signal selected from the channel R reaches the pin 1 of N411 after being amplified through the low pass filter N408B. N411's pin 9 (SEL) is the low level. According to the real value table, the S-SW signal sent out from the pin 4 is added to the pin 6 of N402 where the electronic volume is adjusted. The pins 10&11 (SWLL) are high level. According to the real value table, the central channel signal (S-C) sent out from the pin 14 of N411 and the surround channel signal (S-S) sent out from the pin 15 of N411 are added to the pins 12, 2 and 5 of N410. (The S-S is divided into two signals surround left and surround right.) At this time, the pins 9, 10 and 11 (SEL) are low level. According to the real value table, these three lines of signals sent out from the pins 14, 15 and 4 reach the IC N410 where the volume is adjusted separately. This unit is in the six-channel output mode.

The relationship of all input source switches and sound processing mode is shown as Figure 1.



(Figure 1)

## 2. Volume adjustment, sound field processing and EQ adjustment circuits.

All channel signals are sent to N402 inside which the independent volume adjustment, EQ adjustment and all sound field modes process are performed.

The sound field processing and EQ adjusting circuit is mainly processing the L&R channel signals. According to the schematic diagram, the L&R channel signals are added simultaneously to the pins 15, 17, 13 and 16 of N402. When the unit mode is in the Hi-Fi mode, the internal circuit of the pins 17&16 is connected and the other input signals are cutoff. At this time, only the L&R channel volume can be adjusted and only the pins 31&32 send out signals. Therefore, the unit is in the 2CH output mode. The unit mode is not in the Hi-Fi mode, other input signals are connected but the pins 17&16 signals are cutoff. At this time, all channel volumes can be adjusted independently and the sound field processing or EQ adjusting of the L&R channels can be performed. Finally, all channel signals pass out from the pins 31, 32, 33, 34, 35&36. The SW channel signal from the pin 36 reaches the amplified speakers to be amplified through the SW output terminals. Other channel signals reach to the power amplifying circuit to be amplified. The L&R channel signals will go through 1<sup>st</sup> grade LPF and MIX amplification (Karaoke signals are overlapped into L & R channels).

## 3. Input signals detect, search and frequency spectrum sampling circuits

3.1 Input signals detect and search circuit: The six channel signal lines of the input IC N402 are connected with 100K sampling resistors R533, R534, R657, R676 and R678 respectively. The signals are mixed by these resistors and added to the opposite-phase input terminal to be amplified. VD431 and C481 connected to N403B's output end constitute half-wave rectifying filter circuit. Then the signals reach the voltage comparator composed of N403A. The output end of N403A (SEARCH) is connected to the pin 28 of CPU. This control signal is the search and detect signal: when it is low level, it enters the search mode; when it is high level, it stops searching. Its work is as follows:

3.1.1 When this unit is getting started, the A&B control signals from the pins 38&39 in the domination of the CPU's interprogram are added to the input select circuit to search circularly once. When there are no signals in these four input connectors, the VCD mode stops automatically. When there are signals in one of the four connectors, AC signals will appear in all channels of the input N402. These AC signals are amplified by N403B and rectified and filtered by VD434 and C481 to become DC signals. At this time, the opposite-phase voltage of N403A is 0.01V. When this DC voltage surpasses 0.01V, the output end of N403B sends out a high level (SEARCH) close to positive power supply voltage (A+6V) which reaches the pin 28 of CPU. CPU keeps searching in the connector in which there are input signals and the unit will play normally.

1.2.2 When press the SEARCH on the front panel, CPU sends out A&B control signals again to start searching. Meanwhile, the pin 27 (EX) sends out a high level which makes V446 inductive. The emitter of V446 sends out a high level which passes through R498 which makes the opposite-phase voltage of N403A to be 0.4V. That is to say, if you want to stop searching of CPU, the gained voltage after the input signals are rectified and filtered must exceed 0.4V. This voltage is higher than 0.01V when this unit is getting started in order to avoid that the CPU receives signals mistakenly and stops searching due to the large external interference signals. If the input signals' amplitude is not high enough, CPU will continue searching. When the amplitude is high enough, N403A sends out high level to the pin 28 to stop searching. The pin 27 (EX) will become low level again and the opposite-phase voltage of N403A will also return back to 0.01V. The whole searching process is finished.



## GENERAL DESCRIPTION

The W78E54 is an 8-bit microcontroller that is functionally compatible with the W78C54, except that the mask ROM is replaced by a flash EEPROM with a size of 16 KB. To facilitate programming and verification, the flash EEPROM inside the W78E54 allows the program memory to be programmed and read electronically. Once the code is confirmed, the user can protect the code for security.

The W78E54 microcontroller supplies a wider frequency range than most 8-bit microcontrollers on the market. It is functionally compatible with the industry-standard 80C52 microcontroller series, except that one extra 4-bit bit-addressable I/O port (Port 4) and two additional external interrupts (INT2, INT3).

The W78E54 contains four 8-bit bidirectional and bit-addressable I/O ports, three 16-bit timer/counters, and a serial port. These peripherals are supported by a eight-source, two-level interrupt capability. There are 256 bytes of RAM and an 16 KB flash EEPROM for application programs.

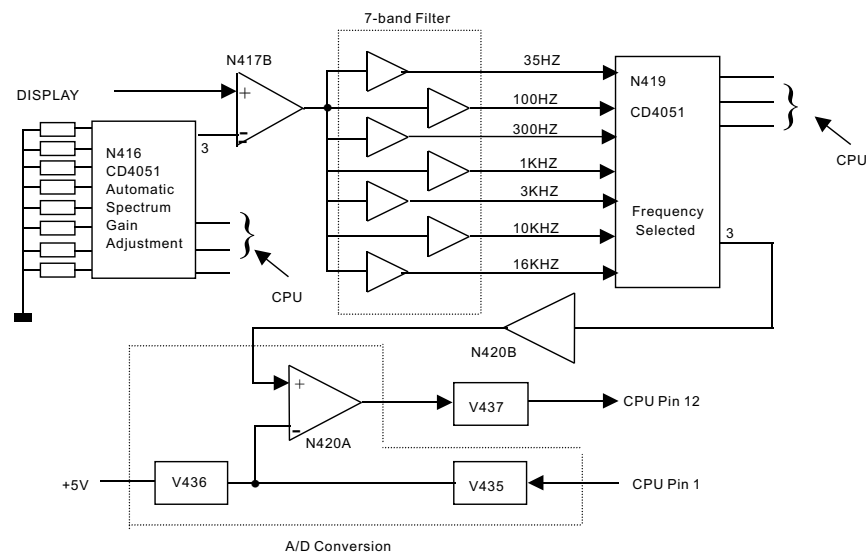
The W78E54 microcontroller has two power reduction modes, idle mode and power-down mode, both of which are software selectable. The idle mode turns off the processor clock but allows for continued peripheral operation. The power-down mode stops the crystal oscillator for minimum power consumption. The external clock can be stopped at any time and in any state without affecting the processor.

## FEATURES

- 8-bit CMOS microcontroller
- Fully static design
- Low standby current at full supply voltage
- DC-40 MHz operation
- 256 bytes of on-chip scratchpad RAM
- 16 KB electrically erasable/programmable EPROM
- 64 KB program memory address space
- 64 KB data memory address space
- Four 8-bit bidirectional ports
- One extra 4-bit bit-addressable I/O port, additional INT2 / INT3 (available on 44-pin PLCC/QFP package)
- Three 16-bit timer/counters
- One full duplex serial port
- Boolean processor
- Eight-source, two-level interrupt capability
- Built-in power management
- Code protection mechanism



4.3 Spectrum analyzingcircuit (The flow chart is shownan Figure 2)

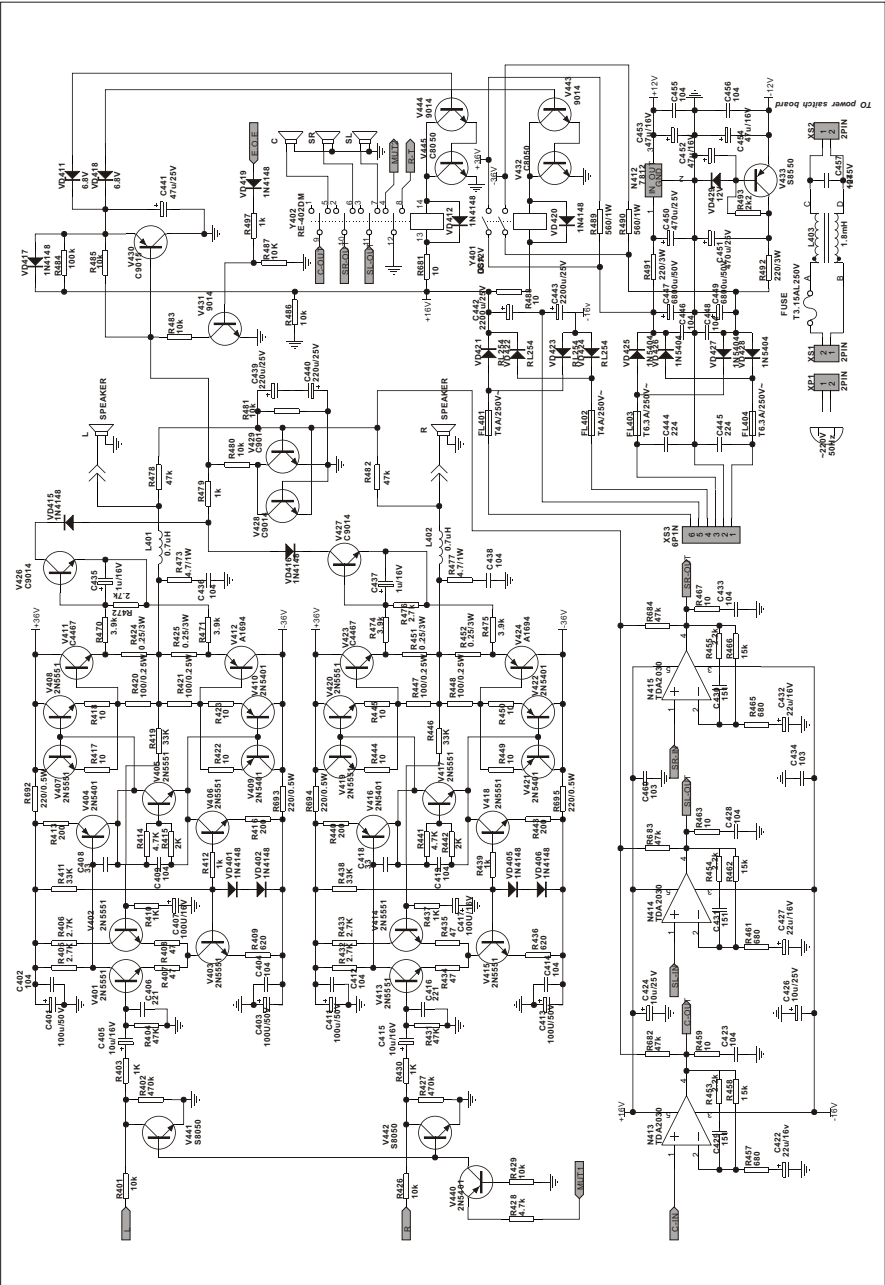


(Figure 2)

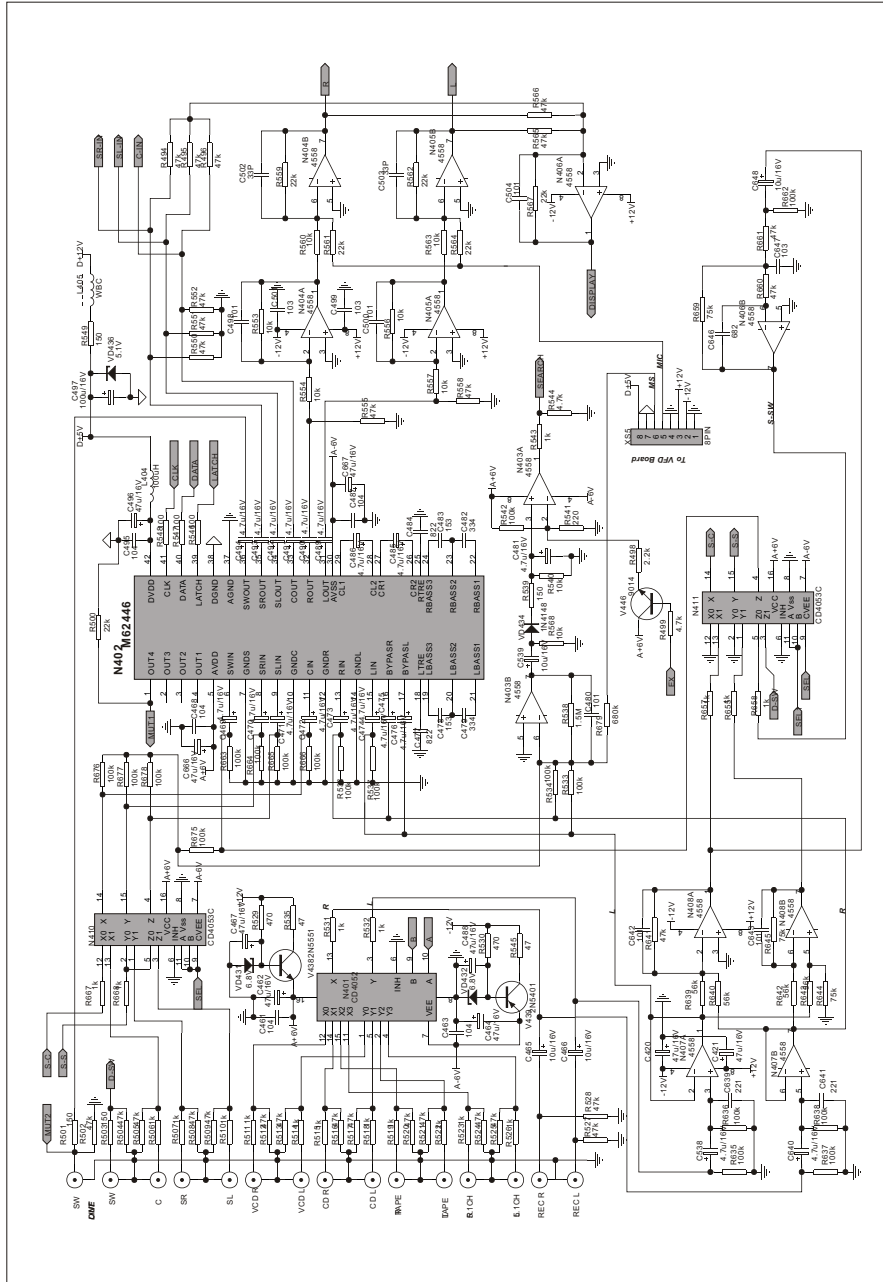
4.3.1 Automaticspectrum gain adjustmentcircuit: In order to avoid thatthe display amplitude is toonarrow when theinput signals aretoo weak orthe whole display appears when the input signals are too strong, this unit incorporates an automatic spectrum gain adjustmentcircuit which employs a single channel 1-out-of-8 electronic analog switch N416(CD4051). Its real value table is below. Itsworking principle is that it changes the opposite-phase groundresistor's resistance value of the operational amplifier N417B to change thegain times.

We have mentioned before thatthe spectrum analyzing signal source is sent to the operational amplifier N417B's in-phase input terminal to be amplified. Its amplified times depend on the resistance value of the resistor connected through the electronic switch N416 to the opposite-phase terminal. When the master volume is too big, the CPU will automatically add the ground resistor's resistance value to reduce the am plification times. When the master volume is too small, the CPU will automatically reduce the ground resistor's resistance value to increase the amplification times. CD4051Real Value Table

| CD4051 Real Value Table |    |    |    |    |    |    |    |    |
|-------------------------|----|----|----|----|----|----|----|----|
|                         | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
| A                       | 0  | 1  | 0  | 1  | 0  | 1  | 0  | 1  |
| B                       | 0  | 0  | 1  | 1  | 0  | 0  | 1  | 1  |
| C                       | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  |

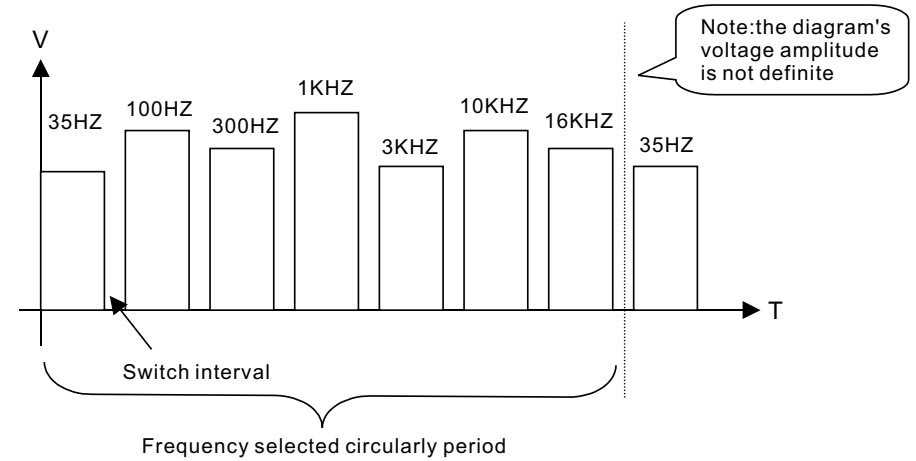


## SCHEMATIC DIAGRAM OF THE MAIN AMP BOARD



## 4.3.2 Frequency Selected Circuit

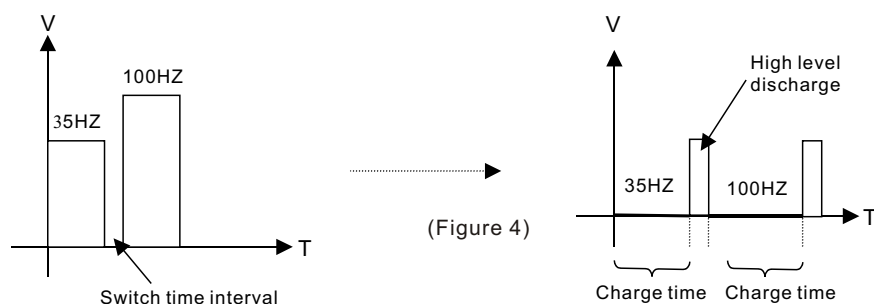
The signal amplified by the N417B is coupled by C508 and then sent to the 7-band filter composed of the operational amplifiers. Setting its feedback capacitor's capacity can define the corresponding frequency amplitude. The frequency value marked on their output points is the frequency band's central frequency. There's a half-wave rectifying circuit connected to the every band filter's output end. The circuit will rectify the amplified AC signals into the DC voltage. The circuit is mainly performing the frequency sampling function which can show the amplitude of every frequency of the whole audio signals through the DC voltage. If the low frequency of the current audio signals is strong, the DC voltage of the 35Hz and 100Hz band filter is higher. If the high frequency is strong, the DC voltage of the 10K and 16K band filter is higher. The output end of these seven band filters is connected to seven input terminals of the electronic switch N419 (CD4051). CPU will send commands to make this electronic switch select the frequencies circularly (Refer to the above real value table). The output terminal of the pin 3 of N419 will send out a series of voltage representing the corresponding frequency's amplitude. (See Figure 3)



(Figure 3)

4.3.3 A/D conversion and display output circuit: The output voltage from the pin3 of N419 passes through N420B where it is amplified and sent to the opposite-phase terminal of N420A. N420A composes a voltage comparer. We'll discuss its detailed working process according the voltage comparing characteristics (When the in-phase end's voltage is higher than that of the opposite-phase end, the output is the positive power. When the in-phase end's voltage is lower than that of the opposite-phase end, the output is the negative power.) and the figure 4.

When the opposite-phase end has a DC voltage representing 35Hz signal amplitude, the output of N420A is a low level close to the negative power supply. At the same time, +5V provides conditions for V436 to be conductive and a high level from the collector of V436 charges C530. The positive end's voltage of C530 (i.e. the in-phase end of N420A) is increasing gradually. When the voltage reach that of the opposite-phase end, the voltage comparer will overturn. Therefore, N420 sends out a high level close to the positive power supply voltage. When the comparer overturns, CPU will terminate the 35Hz level selection and switch to the next frequency 100Hz. During the switch interval, an instantaneous high level from the pin 1 of CPU makes V435 conductive and the voltage of C530 will be released. The in-phase end of N420A will be charged from 0 level to 100Hz. When 100Hz charge is finished, it will switch to the next frequency. The process is circulated under CPU's control. The charging time from the 0 level to overturn represent current frequency's signal amplitude. The amplitude is large, time is longer; the amplitude is small, time is shorter. We can conclude from the above circuit working process: An analog series of DC level which has concrete voltage value originally becomes two mode of 0 and 1. Its time period represents the digital pulse of the original information. That is to say, it finishes the analog-to-digital conversion process. The digital pulse sent out from the output terminal of N420A reaches the pin 12 of CPU after opposite-phased by V437. And then CPU processes it and sends it to front panel display IC N901 which will make dynamic spectrum display on the display. As a matter of fact, every frequency is displayed sequentially. However, what we see on the display screen is the working process all the spectrums are displayed simultaneously due to every frequency display circulate very quickly.



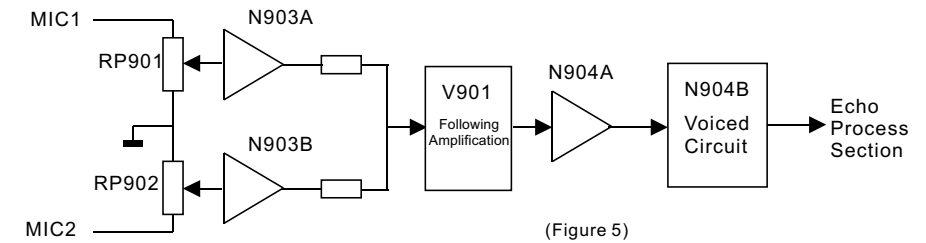
|     |                  |                                 |                                                                                                                                                                                                                          |
|-----|------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 127 | CONNECTION CORDS | 1 6 SHAPED 10mm                 | W4,W6,W7,W9,W13,W17,W23,W25,W29,W31,W32,W35,W40,W41,W44-W47,W54,W55,W62,W65,W80,W90,W97,W103,W111,W112,W117,W121,W122,W133,W137,W142,W143,W154,W163,W167,W168,W174,W177,W178,W180,W181,W185,W186,W190,W207,W208,W209,W37 |
| 128 | CONNECTION CORDS | 1 6 SHAPED 12.5mm               | W57,W60,W67,W68,W70,W71,W77,W93,W104,W120,W123,W124,W128,W130,W131,W144,W145,W148,W204                                                                                                                                   |
| 129 | CONNECTION CORDS | 1 6 SHAPED 15mm                 | W83,W85,W86,W107,W115,W126,W129,W146,W147,W169-W173,W175,W176,W182,W183,W191,W201,W82                                                                                                                                    |
| 130 | CONNECTION CORDS | 1 6 SHAPED 20mm                 | W33,W34,W48,W51,W114,W132,W134,W141,W166,W192,W196,W200,W203                                                                                                                                                             |
| 131 | CABLE            | 20# 60mm BLACK WITH CHIP SOLDER | GROUND WIRE                                                                                                                                                                                                              |
| 132 | CABLE            | 18# 70mm BLACK                  | XJ1-XJ2                                                                                                                                                                                                                  |
|     | CABLE            | 22# 80mm BLACK                  | XJ1-XJ2                                                                                                                                                                                                                  |
| 133 | FUSE TUBE        | T6.3AL 250V                     | FL403,FL404                                                                                                                                                                                                              |
| 134 | FUSE TUBE        | T4AL 250V                       | FL405,FL401,FL402                                                                                                                                                                                                        |
| 135 | FUSE HOLDER      | BLX-2                           | FL405                                                                                                                                                                                                                    |
| 136 | RADIATOR BOARD   | 30# 16# 6 AB207                 | SRQ401                                                                                                                                                                                                                   |
| 137 | LARGE RADIATOR   | 267.5# 1470 AV210               | CONNECTED TO THE MAIN AMPLIFICATION BOARD                                                                                                                                                                                |
| 138 | FUSE HOLDER      |                                 | 0 FL401-FL404                                                                                                                                                                                                            |
| 139 | SMALL CHIP       | AB207                           | FIX TRIODE                                                                                                                                                                                                               |
| 140 | ANGLE ALUMINUM   | 90# 23.2# 0 AV210               | POWER IC / LARGE RADIATOR                                                                                                                                                                                                |
| 141 | TAPPING SCREW    | BT 3# 8 BLACK                   | 2 FOR RADIATOR BOARD/MAIN AMPLIFICATION BOARD, 1 FOR N412/RADIATOR BOARD                                                                                                                                                 |
| 142 | TAPPING SCREW    | PB 3# 12H COLOR ZINC            | 2 FOR SMALL CHIP/LARGE RADIATOR, 5 FOR ANGLE ALUMINUM/LARGE RADIATOR                                                                                                                                                     |
| 143 | TAPPING SCREW    | PWT 3# 8# 8 COLOR ZINC          | 1 FOR MAIN AMPLIFICATION/RADIATOR, GROUNDED                                                                                                                                                                              |
| 144 | TAPPING SCREW    | BT 3# 8H COLOR ZINC             | 1 FOR MAIN AMPLIFICATION/RADIATOR, 3 FOR ANGLE ALUMINUM/POWER IC                                                                                                                                                         |
| 145 | MACHINE SCREW    | PWM 3# 16# 8 COLOR ZINC         | 4 FOR POWER TUBE/LARGE RADIATOR                                                                                                                                                                                          |
| 146 | SCREW NUT        | M3                              |                                                                                                                                                                                                                          |
| 147 | SCREW SPACER     | 1 6 47.2# 0.5                   |                                                                                                                                                                                                                          |
| 148 | SPRING SPACER    | 1 6                             |                                                                                                                                                                                                                          |
| 149 | INSULATION RING  | 1 6 46# 8                       | N413-N415                                                                                                                                                                                                                |
| 150 | MICA SPACER      | 18# 13# 0, 1                    | 3 FOR IC (N413,N414,N415) / RADIATOR                                                                                                                                                                                     |
| 151 | MICA SPACER      | 22# 19# 0, 1                    | 4 FOR POWER TUBE / RADIATOR                                                                                                                                                                                              |

|     |                               |                             |                                                                                                                                                                                                                                                                                                                                                                    |
|-----|-------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 92  | VOLTAGE<br>REGULATOR<br>DIODE | 5.1V 1/2W                   | VD436,VD411                                                                                                                                                                                                                                                                                                                                                        |
| 93  | VOLTAGE<br>REGULATOR<br>DIODE | 12V 1/2W                    | VD429                                                                                                                                                                                                                                                                                                                                                              |
| 94  | VOLTAGE<br>REGULATOR<br>DIODE | 6.8V 1/2W                   | VD431,VD432,VD438,VD439                                                                                                                                                                                                                                                                                                                                            |
| 95  | TRIODE                        | 2N5401                      | V404,V409,V410,V416,V421,V422,V440,V436,V439                                                                                                                                                                                                                                                                                                                       |
| 96  | TRIODE                        | 2N5551                      | V401,V402,V403,V405~V408,V413,V414,V415,V417~V420,<br>V435,V437,V438                                                                                                                                                                                                                                                                                               |
| 97  | TRIODE                        | 8050C                       | V432,V445,V441,V442                                                                                                                                                                                                                                                                                                                                                |
| 99  | TRIODE                        | 9014C                       | V426~V429,V431,V443,V444,V446                                                                                                                                                                                                                                                                                                                                      |
| 100 | TRIODE                        | 9015C                       | V430                                                                                                                                                                                                                                                                                                                                                               |
|     | TRIODE                        | S8550D                      | V433                                                                                                                                                                                                                                                                                                                                                               |
| 101 | TRIODE                        | KB688O                      | V412,V424                                                                                                                                                                                                                                                                                                                                                          |
|     | TRIODE                        | KB688V                      | V412,V424                                                                                                                                                                                                                                                                                                                                                          |
| 102 | TRIODE                        | KD718O                      | V411,V423                                                                                                                                                                                                                                                                                                                                                          |
|     | TRIODE                        | KD718Y                      | V411,V423                                                                                                                                                                                                                                                                                                                                                          |
| 103 | IC                            | LM324N DIP                  | N417,N418                                                                                                                                                                                                                                                                                                                                                          |
| 104 | IC                            | NJM4558D DIP                | N403~N408,N420                                                                                                                                                                                                                                                                                                                                                     |
|     | IC                            | 4558C DIP                   | N403~N408,N420                                                                                                                                                                                                                                                                                                                                                     |
| 105 | IC                            | L7812CV GOLD-SEALED TO-220  | N412                                                                                                                                                                                                                                                                                                                                                               |
|     | IC                            | LM7812 GOLD-SEALED TO-220   | N412                                                                                                                                                                                                                                                                                                                                                               |
| 106 | IC                            | CD4051 DIP                  | N416,N419                                                                                                                                                                                                                                                                                                                                                          |
| 107 | IC                            | CD4053BCN DIP               | N410,N411                                                                                                                                                                                                                                                                                                                                                          |
| 108 | IC                            | CD4052BCN DIP               | N401                                                                                                                                                                                                                                                                                                                                                               |
| 109 | IC                            | M62446FP SOP                | N402                                                                                                                                                                                                                                                                                                                                                               |
| 110 | IC                            | 24C02 DIP                   | N421                                                                                                                                                                                                                                                                                                                                                               |
| 111 | IC                            | LM1875T T05B                | N413,N414,N415                                                                                                                                                                                                                                                                                                                                                     |
| 112 | SOFTWARE<br>PROGRAM CPU       | CPU-AV210(RU)-0             | N422                                                                                                                                                                                                                                                                                                                                                               |
| 113 | CRYSTAL<br>OSCILLATOR         | 12.00MHz 49-U               | G601                                                                                                                                                                                                                                                                                                                                                               |
| 114 | RELAY                         | JH1806-012-(3H1J 1/2) DC12V | Y402                                                                                                                                                                                                                                                                                                                                                               |
| 115 | RELAY                         | JH4237-012-2H DC12V         | Y401                                                                                                                                                                                                                                                                                                                                                               |
| 116 | PCB                           | 4210-3                      |                                                                                                                                                                                                                                                                                                                                                                    |
| 117 | TERMINAL<br>SOCKET            | AV6-8.4-53                  | XC401                                                                                                                                                                                                                                                                                                                                                              |
| 118 | TERMINAL<br>SOCKET            | AV8-8.4-62                  | XC402                                                                                                                                                                                                                                                                                                                                                              |
| 119 | TERMINAL<br>SOCKET            | AV1-8.4-5 BLACK             | XC403                                                                                                                                                                                                                                                                                                                                                              |
| 120 | SOCKET                        | 8 PINS 2.5mm                | XS5                                                                                                                                                                                                                                                                                                                                                                |
| 121 | SOCKET                        | 9 PINS 2.5mm                | XS4                                                                                                                                                                                                                                                                                                                                                                |
| 122 | SOCKET                        | 2 PINS 7.92mm               | XS1,XS2                                                                                                                                                                                                                                                                                                                                                            |
| 123 | SOCKET                        | 6 PINS 3.96mm               | XS3                                                                                                                                                                                                                                                                                                                                                                |
| 124 | CONNECTOR'S<br>SOCKET         | WP4-10A                     | XL401                                                                                                                                                                                                                                                                                                                                                              |
| 125 | CONNECTOR'S<br>SOCKET         | WP6-10A                     | XL402                                                                                                                                                                                                                                                                                                                                                              |
| 126 | CONNECTION<br>CORDS           | φ6 SHAPED 7.5mm             | W1~W3,W5,W8,W10~W12,W14~W16,W18~W22,W24,<br>W26~W28,W30,W36,W38,W39,W42,W43,W49,W50,W52,<br>W53,W56,W58,W59,W61,W63,W64,W66,W69,W72~W76,<br>W78,W79,W81,W84,W87~W89,W91,W92,W94~W96,<br>W98~W102,W105,W106,W108~W110,W113,W116,<br>W118,W119,W125,W127,W135,W136,W138~W140,<br>W149~W153,W155~W162,W164,W165,W179,W184,<br>W187~W189,W193~W195,W197~W199,W205,W206 |

## 5. Microphone Circuit

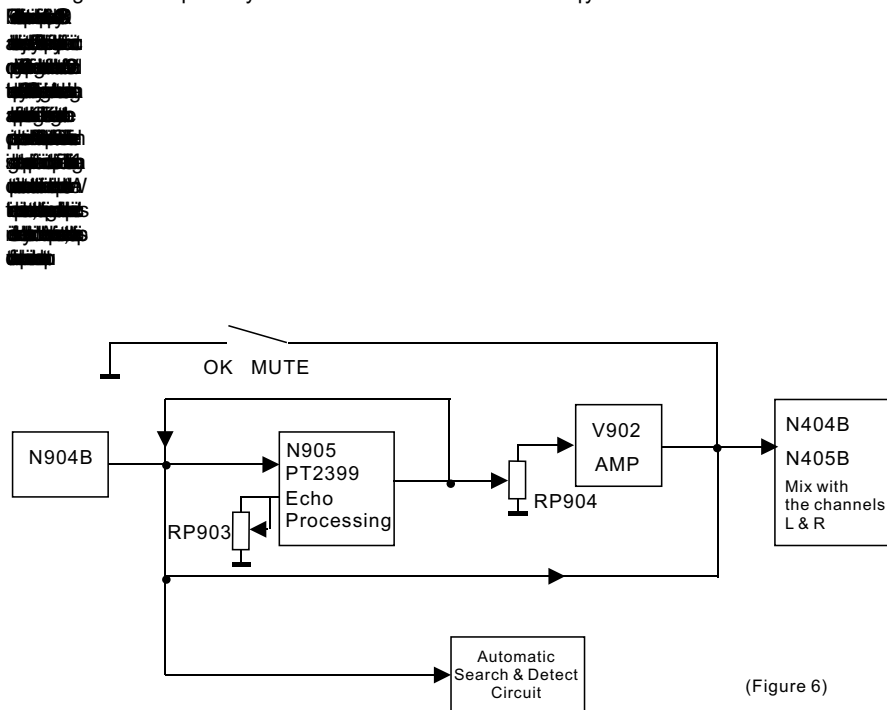
The microphone circuit is divided into two parts: The Front Process Section and Echo Process Section

5.1 Front Section Circuit: Mainly performing volume adjusting/amplifying/modifying function. The flow chart is shown as Figure 5.



## 5.2 Echo Process Section

The flow chart is shown as Figure 6. The front section signal is divided into three lines: One line is sent by R980 and C958 to N403B's opposite-phase end. This line is just the signal search and detect circuit we have mentioned before. When the front section circuit of the microphone has signal output, the auto-search mode will be stopped. Another line of signal is sent directly after being coupled by R946 and C926. This line is the stereo channel of the echo channels. The third line is the feedback channel which is coupled by R947, C927, C928 and R948 and then sent to the echo process IC N905's 16<sup>th</sup> pin. The line is LPF amplified and digitally delayed and then sent out from the pin 14. The RP903 connected to the pin 6 is the echo delay adjustment potentiometer. The pin 14's signal is coupled by R951 and R952 into two lines:



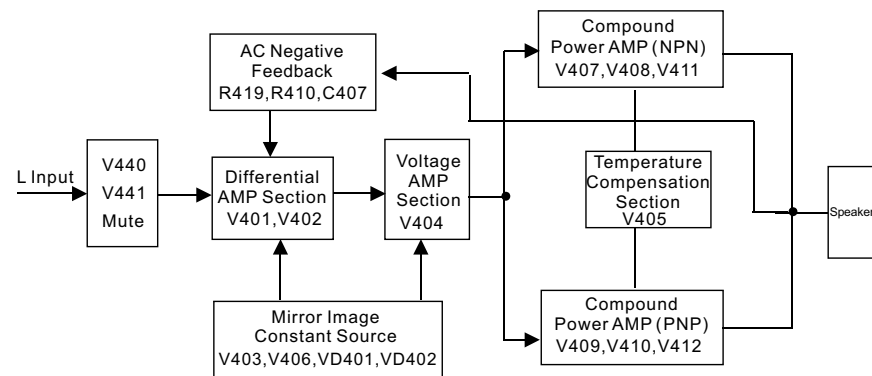
(Figure 6)

|    |                                |                               |                                                                                            |
|----|--------------------------------|-------------------------------|--------------------------------------------------------------------------------------------|
| 59 | PORCELAIN CAPACITOR            | 50V 683 ±10J 5mm              | C521,C522                                                                                  |
| 60 | PORCELAIN CAPACITOR            | 50V 154 +80%-20% 5mm          | C527,C528                                                                                  |
|    | PORCELAIN CAPACITOR            | 100V 104±20J 5mm              | C412,C414,C402,C404,C458,C459,C434,C460                                                    |
| 61 | TERYLENE CAPACITOR             | 100V 104 ±10% 7mm             | C423,C428,C433,C436,C438                                                                   |
| 62 | TERYLENE CAPACITOR             | 100V 224 ±10% 8mm             | C444,C445                                                                                  |
| 63 | TERYLENE CAPACITOR             | 100V 472 ±5% 3.5mm            | C646                                                                                       |
|    | TERYLENE CAPACITOR             | 63V 104 ±5% 5mm               | C446,C448                                                                                  |
| 64 | METAL POLYESTER FILM CAPACITOR | CL21X 63V 153 ±5% 5           | C478,C483                                                                                  |
| 65 | METAL POLYESTER FILM CAPACITOR | CL21X 100V334±10% 7.5         | C479,C482                                                                                  |
| 66 | METAL POLYESTER FILM CAPACITOR | CL21X 100V 104 ±10J 5         | C530                                                                                       |
| 67 | CD                             | CD11 16V10U±20%5H 1 2         | C465,C466,C507,C508,C531,C405,C415,C539,C648                                               |
|    | CD                             | CD11 25V10U±20%5H 1 2         | C465,C466,C507,C508,C531,C405,C415,C539,C648                                               |
| 68 | CD                             | CD11 16V22U±20%5H 1 2         | C427,C432,C422                                                                             |
| 69 | CD                             | CD11 16V47U±20%5H 1 2         | C420,C421,C464,C462,C467,C488,C505,C506,C535,C452 C666~C669,C453,C454,C496,C665            |
| 70 | CD                             | CD11 16V100U±20%6H 2 2.5      | C407,C417,C497                                                                             |
| 71 | CD                             | CD11 50V2.2U±20%5H 1 2        | C511,C514,C517,C523                                                                        |
| 72 | CD                             | CD11 50V4.7U±20%5H 1 2        | C424,C426,C670,C671                                                                        |
| 73 | CD                             | CD11 25V100U±20%6H 2 2.5      | C441                                                                                       |
| 74 | CD                             | CD11 25V220U±20%8H 2 3.5      | C439,C440                                                                                  |
| 76 | CD                             | CD11 35V470U±20%10H 2 5       | C450,C451                                                                                  |
| 77 | CD                             | CD11 50V100U±20%8H 2 3.5      | C403,C413,C401,C411                                                                        |
| 78 | CD                             | CD11 16V1U±20%5H 1 2          | C435,C437                                                                                  |
| 79 | CD                             | CD11 16V4.7U±20%5H 1 2        | C469~C476,C481,C485,C486,C489~C494,C538,C640                                               |
|    | CD                             | CD110 35V3300U±20%16H 5 7.5   | C442,C443                                                                                  |
|    | CD                             | CD11C 50V2.2U±20%4H 1.5       | C520,C526,C529                                                                             |
| 80 | CD                             | LUA 50V6800U±20%30H 5 10      | C447,C449                                                                                  |
| 83 | MAGNETIC BEADS INDUCTANCE      | W4B WBC 6H10-1.5T             | L405                                                                                       |
|    | MAGNETIC BEADS INDUCTANCE      | 100UH ±10% 0410 VERTICAL 10mm | L404                                                                                       |
|    | INDUCTANCE                     | 47UH ±10% 0410 VERTICAL 10mm  | L406                                                                                       |
| 84 | INDUCTANCE COIL                | 0.7UH SC-0.8*8.0H 1.5         | L401,L402                                                                                  |
| 85 | CHOKE COIL                     | UU10.5-1.8mH                  | L403                                                                                       |
| 86 | DIODE                          | 1N4004                        | VD409                                                                                      |
| 87 | DIODE                          | 1N4148                        | VD440~VD446,VD448,VD449,VD450,VD401,VD402,VD405, VD406,VD415~VD417,VD419,VD420,VD434,VD412 |
| 88 | DIODE                          | RL254                         | VD421~VD424                                                                                |
| 89 | DIODE                          | 1N5404                        | VD425~VD428                                                                                |
| 90 | VOLTAGE REGULATOR DIODE        | 3.3V 1/2W                     | VD447                                                                                      |
| 91 | VOLTAGE REGULATOR DIODE        | 4.7V 1/2W                     | VD410                                                                                      |

|    |                           |                          |                                                                 |
|----|---------------------------|--------------------------|-----------------------------------------------------------------|
| 30 | CD                        | CD11 25V220U±20%8H2 3.5  | C415,C416                                                       |
| 31 | CD                        | CD11 35V470U±20%10H20 5  | C423,C424                                                       |
| 32 | CD                        | CD11 50V1U±20%5H1 2      | C411,C412                                                       |
| 33 | CD                        | CD11 50V10U±20%5H1 2     | C435,C436,C437,C438,C417                                        |
| 34 | CD                        | CD11 35V47U±20%6H2 2.5   | C439,C440,C441,C442                                             |
| 35 | CD                        | CD11 35V100U±20%8H2 3.5  | C418                                                            |
| 36 | CD                        | LUA 35V6800U±20J 80H5 10 | C421,C422                                                       |
| 37 | DIODE                     | 1N4004                   | VD407,VD408,VD419                                               |
| 38 | DIODE                     | 1N4148                   | VD401~VD406,VD418                                               |
| 39 | DIODE                     | 1N5404                   | VD410~VD413                                                     |
| 40 | VOLTAGE REGULATOR DIODE   | 12V 1/2W                 | VD415,VD414,VD409                                               |
| 41 | VOLTAGE REGULATOR DIODE   | 6.8V 1/2W                | VD417,VD416                                                     |
| 42 | TRIODE                    | 2N5401                   | V404,V408,V414,V418,V429,V431,V433                              |
| 43 | TRIODE                    | 2N5551                   | V401,V402,V403,V405,V407,V411~V413,V415,V417,V428,V430,V432     |
| 44 | TRIODE                    | 9014C                    | V406,V416,V421,V422,V423,V424,V426,V427,V434,V435               |
| 45 | TRIODE                    | 9015C                    | V425                                                            |
| 46 | TRIODE                    | KB6880                   | V410,V420                                                       |
| 47 | TRIODE                    | KB688Y                   | V410,V420                                                       |
| 47 | TRIODE                    | KD7180                   | V409,V419                                                       |
| 47 | TRIODE                    | KD718Y                   | V409,V419                                                       |
| 48 | IC                        | CD4052BCN DIP            | N401                                                            |
| 49 | RELAY                     | JH4237-024-2H DC24V      | Y401,Y402                                                       |
| 50 | PCB                       | 4217J 3                  |                                                                 |
| 51 | TERMINAL SOCKET           | AV6-8.4-3B               | XC2                                                             |
| 52 | TERMINAL SOCKET           | AV4-8.4-3B               | XC1                                                             |
| 53 | SOCKET                    | 3 PIN 2.5mm              | XS3,XS4                                                         |
| 54 | SOCKET                    | 6 PIN 2.5mm              | XS5                                                             |
| 55 | SOCKET FOR EXTERNAL CORDS | WP6-1B                   | XL1                                                             |
| 56 | POLE SOCKET               | WP4-10A                  | XC3                                                             |
| 57 | CONNECTION CORDS          | φ6 SHAPED 7.5mm          | W29,W32,W35,W36,W39,W48,W54,W58,W13                             |
| 58 | CONNECTION CORDS          | φ6 SHAPED 10mm           | W10~W12,W15,W19~W21,W27,W31,W33,W34,W37,W43,W44,W47,W51,W53,W55 |
| 59 | CONNECTION CORDS          | φ6 SHAPED 12.5mm         | W14,W16,W49,W50,W56                                             |
| 60 | CONNECTION CORDS          | φ6 SHAPED 15mm           | W5,W7,W17,W18,W22,W23~W26,W28,W30,W45,W46,W40,W41,W52           |
| 61 | CONNECTION CORDS          | φ6 SHAPED 20mm           | W38,W42,W57                                                     |
| 62 | FUSE TUBE                 | T6.3AL 250V              | FL401,FL402                                                     |
| 63 | LARGE RADIATOR            | 204*80*61 AB217          | CONNECT TO THE MAIN AMP BOARD                                   |
| 64 | FUSE HOLDER               |                          | FL401,FL402                                                     |
| 65 | SMALL CHIP                | AB207                    | FIX THE TRIODES V406 AND V416                                   |
| 66 | TAPPING SCREW             | PB 3H2H COLOR ZINC       | 2 FOR SMALL CHIP AND LARGE RADIATOR                             |
| 67 | TAPPING SCREW             | PWT 3H8 COLOR ZINC       | 2 FOR PCB/RADIATOR                                              |
| 68 | MACHINE SCREW             | PWM 3H6 COLOR ZINC       | 4 FOR POWER TUBE / LARGE RADIATOR                               |
| 69 | SCREW NUT                 | M3                       | POWER TUBE SCREW                                                |
| 70 | SCREW SPACER              | φ7.2H0.5                 | POWER TUBE SCREW                                                |
| 71 | SPRING SPACER             | φ                        | POWER TUBE SCREW                                                |
| 72 | MICA SPACER               | 24H20H0.1                | 4 FOR POWER TUBE / LARGE RADIATOR                               |

## 6. Power Amplification and Protection Circuit

6.1. Channels L&R Power Amplification Circuit: The L&R power amplifier employs separate components. Taking the L channel as an example, its construction is shown in Figure 7.



(Figure 7)

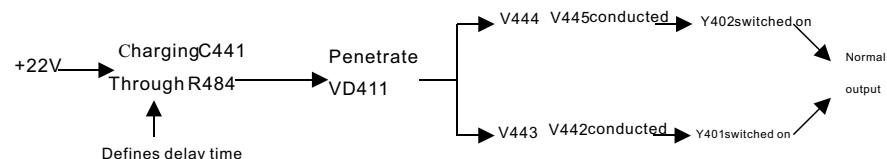
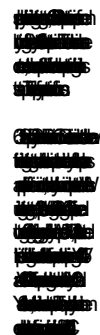
The L channel signal is sent to the power amplification section by the electronic volume adjusting circuit. A mute circuit installed in the input end. When press the MUTE button on the remote control, a high level mute command is sent from the pin 1 of the electronic volume adjusting ICN402. It makes V440 and V441 conductive to finish the mute control function.

The L channel signal is coupled by the R403&C405 and sent to the base of the differential AMP section V401. V401 and V402 compose the single-end input/output differential amplification circuit. The audio signal is sent from the collector of V401 to the base of the voltage amplification section V404 where its voltage is amplified and sent to the compound power amplification section. V403, V406, VD401 and VD402 compose mirror image constant circuit. VD401 and VD402 provide constant base current for V403 and V405. V403's emitter resistor defines the current of the differential amplification section. V406's emitter resistor defines the current of the voltage amplification section.

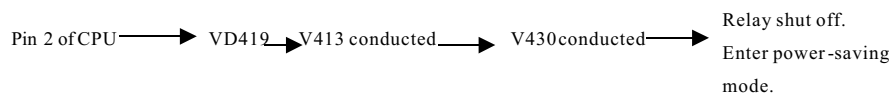
V407, V408 and V411 make up the NPN of compound power amplifier. V407 and V408 are parallel connected. Their function equals a triode (able to amplify power). Then they mix with V411 to constitute NPN compound tube (capable of enhance amplification times). V409, V410 and V412 constitute the PNP of the compound amplifier. Its circuit construction is the same as NPN. The temperature compensation section V405 has two functions in the circuit: First it is a biasing of the NPN and PNP. Its working status defines the static working current of the compound power amplification section. That is to say, we can adjust the inductance degree of V405 to define the static working point of the compound power amplification section. The usual way is to adjust the base resistor of V405. It can also automatically adjust the working status of the compound power amplification section when the temperature rises.

6.2 C, SR and SL power amplification circuit: These three channels employ the exclusive power amplifier IC LM1875 (or TDA2030). It has five pins and is a good power amplifier IC. The application circuit is very simple. It has 15W power output in the rated condition. The pins 5 & 3 are the positive/negative power supplying pins and employ

6.3 Protection circuit: This unit incorporates the power-saving function. The L/R channel's protection is performed by cutting off the relay Y401 to cut off the

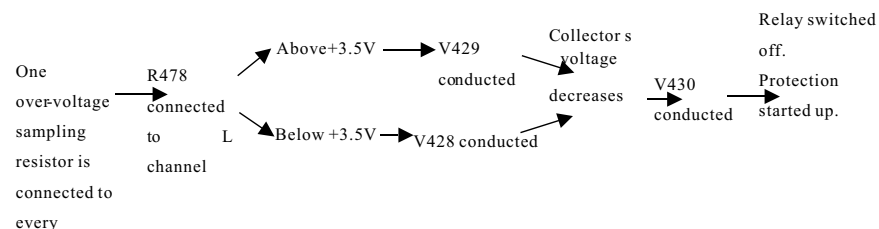


6.3.2 Power-saving Control: When press the POWERSAVING button on the front panel and



remote control, the pin 2 (EOX) of the CPU sends out a high level. It passes through VD419 and reaches to the base of V431. When V431 is conducted, V430 is also conducted. Therefore, the positive end voltage of C441 is decreasing, VD411 is stopped. The relays Y402 and Y401 are cutoff, this unit enters the power-saving mode. At the same time, the CPU sends out data demands to the front panel display IC and then this unit enters the power-saving mode.

6.3.3 Mid-point Over-voltage Protection: An over-voltage sampling resistor is connected to the every channel's output. The channel L's is R478. When there is one output mid-point DC voltage which is higher than +3.5V or lower than 3.5V, V429 and V428 are conducted. Their base voltage will decrease and V430 is conducted. At last, the relay switches off and the protection circuit is getting started.

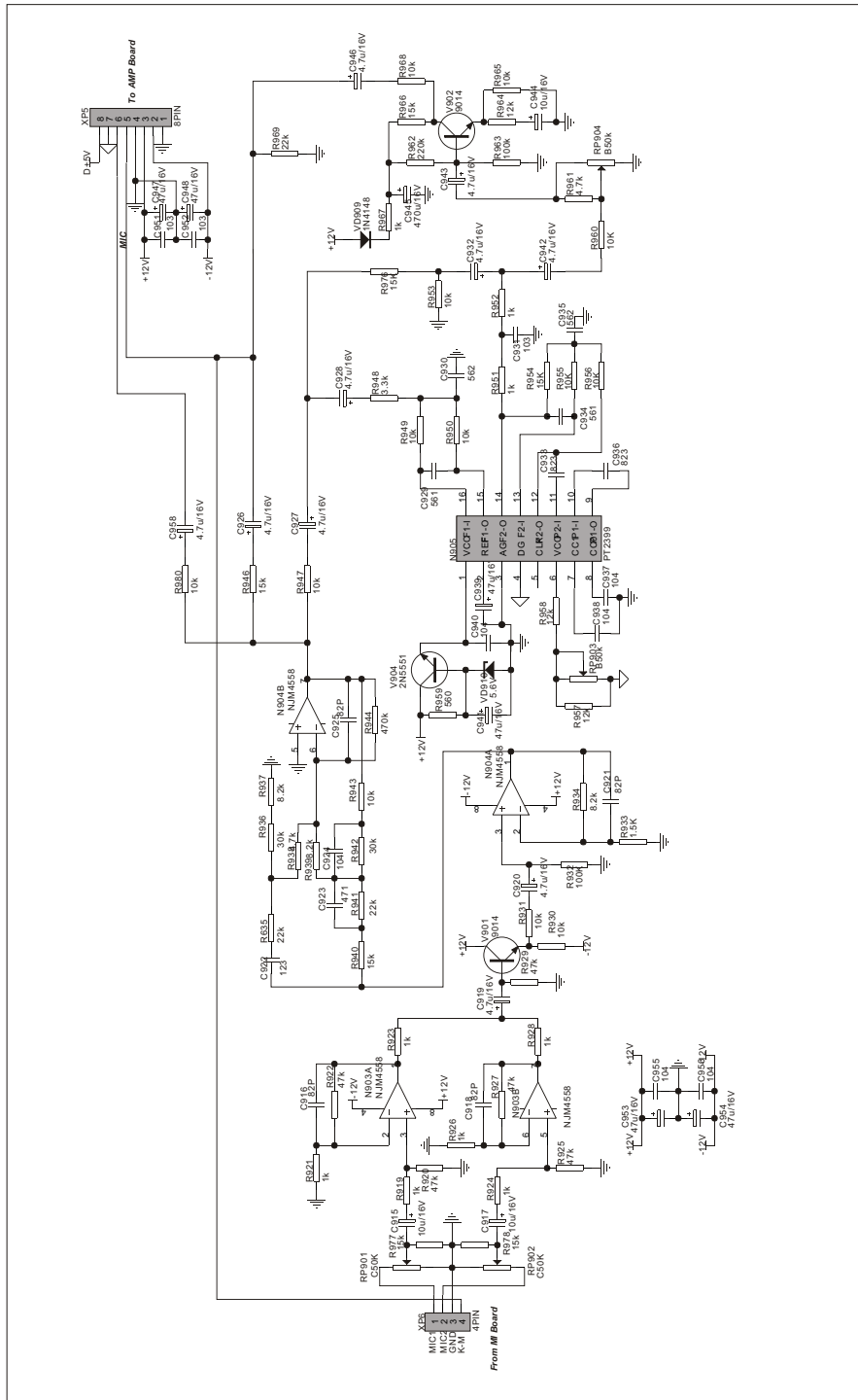


## 2. THE MAIN AMP PART

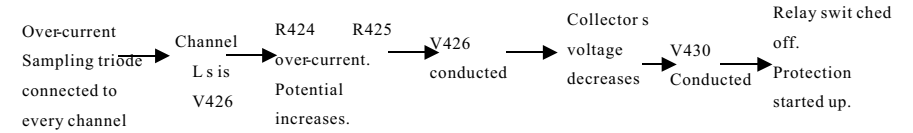
### MAIN PARTS LIST OF THE MAIN AMPBOARD

#### COMPONENTS LIST FO THE MAIN AMPLIFICATION BOARD

| NO. | DESCRIPTION          | SPECIFICATIONS/PART NO.               | LOCATION SPECIFICATIONS                                                                                                                                                                                                |
|-----|----------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | CARBON-FILM RESISTOR | 1/6W10 $\Omega$ $\pm$ 5% SHAPED 7.5   | R417,R418,R422,R423,R444,R445,R449,R450                                                                                                                                                                                |
| 2   | CARBON-FILM RESISTOR | 1/6W100 $\Omega$ $\pm$ 5% SHAPED 7.5  | R546~R548,R541                                                                                                                                                                                                         |
| 4   | CARBON-FILM RESISTOR | 1/6W1K $\pm$ 5% SHAPED 7.5            | R506,R507,R510,R511,R514,R515,R518,R519,R522,R523,R526,R529~R532,R543,R655,R657,R658,R667,R403,R410,R430,R437,R412,R439,R479,R580,R586,R591,R596,R601,R606,R611,R616,R619,R622,R626,R570,R575,R686,R497,R457,R461,R465 |
| 5   | CARBON-FILM RESISTOR | 1/6W1.5K $\pm$ 5% SHAPED 7.5          | R577                                                                                                                                                                                                                   |
| 6   | CARBON-FILM RESISTOR | 1/6W2.2K $\pm$ 5% SHAPED 7.5          | R625,R578,R689,R493,R498                                                                                                                                                                                               |
| 7   | CARBON-FILM RESISTOR | 1/6W4.7K $\pm$ 5% SHAPED 7.5          | R544,R628,R499,R690,R685,R691,R428,R576,R587,R607,R602,R612,R617,R592,R597,R480,R483,R453,R454,R455                                                                                                                    |
| 8   | CARBON-FILM RESISTOR | 1/6W5.6K $\pm$ 5% SHAPED 7.5          | R584,R589,R594,R599,R604,R609,R614,R627                                                                                                                                                                                |
| 9   | CARBON-FILM RESISTOR | 1/6W10K $\pm$ 5% SHAPED 7.5           | R581,R583,R588,R593,R598,R603,R608,R613,R620,R623,R624,R579,R629,R540,R554,R557,R560,R563,R487,R481,R485,R553,R556,R401,R426,R429,R568,R641                                                                            |
| 10  | CARBON-FILM RESISTOR | 1/6W20K $\pm$ 5% SHAPED 7.5           | R661                                                                                                                                                                                                                   |
| 11  | CARBON-FILM RESISTOR | 1/6W22K $\pm$ 5% SHAPED 7.5           | R500                                                                                                                                                                                                                   |
| 12  | CARBON-FILM RESISTOR | 1/6W27K $\pm$ 5% SHAPED 7.5           | R574,R458,R462,R466                                                                                                                                                                                                    |
| 13  | CARBON-FILM RESISTOR | 1/6W33K $\pm$ 5% SHAPED 7.5           | R446,R419                                                                                                                                                                                                              |
| 14  | CARBON-FILM RESISTOR | 1/6W47K $\pm$ 5% SHAPED 7.5           | R502,R527,R528,R550,R551,R552,R555,R558,R660,R404,R431,R504,R505,R508,R509,R512,R513,R516,R517,R520,R521,R524,R525,R682~R684,R536,R537,R663,R664,R665,R666,R567                                                        |
| 15  | CARBON-FILM RESISTOR | 1/6W100K $\pm$ 5% SHAPED 7.5          | R635,R636,R637,R638,R662,R618,R565,R566,R494~R496,R542                                                                                                                                                                 |
|     | CARBON-FILM RESISTOR | 1/6W1M $\Omega$ $\pm$ 5% SHAPED 7.5   | R534                                                                                                                                                                                                                   |
| 16  | CARBON-FILM RESISTOR | 1/4W47 $\Omega$ $\pm$ 5% SHAPED 10    | R535,R545                                                                                                                                                                                                              |
| 17  | CARBON-FILM RESISTOR | 1/4W100 $\Omega$ $\pm$ 5% SHAPED 10   | R420,R421,R447,R448                                                                                                                                                                                                    |
| 18  | CARBON-FILM RESISTOR | 1/4W4.7K $\pm$ 5% SHAPED 10           | R414,R441,R486,R680                                                                                                                                                                                                    |
| 19  | CARBON-FILM RESISTOR | 1/4W33K $\pm$ 5% SHAPED 10            | R411,R438                                                                                                                                                                                                              |
| 20  | CARBON-FILM RESISTOR | 1/4W47K $\pm$ 5% SHAPED 10            | R478,R482                                                                                                                                                                                                              |
| 21  | CARBON-FILM RESISTOR | 1/4W1M $\Omega$ $\pm$ 5% SHAPED 10    | R533,R675,R678                                                                                                                                                                                                         |
| 22  | CARBON-FILM RESISTOR | 1/6W18K $\pm$ 5% SHAPED 7.5           | R559,R561,R562,R564                                                                                                                                                                                                    |
| 23  | CARBON-FILM RESISTOR | 1/6W75K $\pm$ 5% SHAPED 7.5           | R571,R644,R645,R659                                                                                                                                                                                                    |
| 24  | CARBON-FILM RESISTOR | 1/4W2K $\pm$ 5% SHAPED 10             | R415,R442,R688                                                                                                                                                                                                         |
| 25  | CARBON-FILM RESISTOR | 1/6W150 $\Omega$ $\pm$ 5% SHAPED 7.5  | R501,R503,R539                                                                                                                                                                                                         |
| 26  | CARBON-FILM RESISTOR | 1/2W220 $\Omega$ $\pm$ 5% SHAPED 12.5 | R692~R695                                                                                                                                                                                                              |
|     | CARBON-FILM RESISTOR | 1/6W2.2M $\Omega$ $\pm$ 5% SHAPED 7.5 | R679                                                                                                                                                                                                                   |
| 27  | CARBON-FILM RESISTOR | 1/6W2.7K $\pm$ 5% SHAPED 7.5          | R472,R476,R405,R406,R432,R433,R470,R471,R474,R475                                                                                                                                                                      |



6.3.4 Over-current shortcircuit protection: An over-current resistor sampling triode is parallel connected to the output load resistor of the channels L&R respectively. The channel L's sampling tube is V426 and its load resistor is R424 and R425. Another three channel power amplification IC have over-current protection function. When over-current fault occurs to the L or R channel, the potential between R424 and R425 will increase sharply. When it supersedes 0.7V, V426 will get conducted. So will v430. Finally, the relay is switched off and the protection circuit is getting started.



COMPONENTS LIST OF THE FRONT PANEL

| NO. | DESCRIPTION            | SPECIFICATIONS/PART NUMBER            | LOCATION SPECIFICATIONS                                                               |
|-----|------------------------|---------------------------------------|---------------------------------------------------------------------------------------|
| 1   | CARBON-FILM RESISTOR   | 1/6W100 $\Omega$ $\pm$ 5% SHAPED 7.5  | R905,R906,R910,R907                                                                   |
| 2   | CARBON-FILM RESISTOR   | 1/6W560 $\Omega$ $\pm$ 5% SHAPED 7.5  | R959                                                                                  |
| 3   | CARBON-FILM RESISTOR   | 1/6W1K $\pm$ 5% SHAPED 7.5            | R919,R921,R924,R926,R967,R952,R923,R928                                               |
| 4   | CARBON-FILM RESISTOR   | 1/6W1.5K $\pm$ 5% SHAPED 7.5          | R933,R951                                                                             |
| 5   | CARBON-FILM RESISTOR   | 1/6W4.7K $\pm$ 5% SHAPED 7.5          | R916,R970,R971,R972,R938,R961                                                         |
| 6   | CARBON-FILM RESISTOR   | 1/6W10K $\pm$ 5% SHAPED 7.5           | R955,R956,R960,R965,R930,R931,R943,R947,R949, R950,R953,R968,R901~R904,R911~R914,R980 |
| 7   | CARBON-FILM RESISTOR   | 1/6W12K $\pm$ 5% SHAPED 7.5           | R958,R957,R964                                                                        |
| 8   | CARBON-FILM RESISTOR   | 1/6W22K $\pm$ 5% SHAPED 7.5           | R969,R941,R935                                                                        |
| 9   | CARBON-FILM RESISTOR   | 1/6W47K $\pm$ 5% SHAPED 7.5           | R920,R922,R925,R927,R929                                                              |
| 10  | CARBON-FILM RESISTOR   | 1/6W100K $\pm$ 5% SHAPED 7.5          | R932,R963                                                                             |
| 11  | CARBON-FILM RESISTOR   | 1/6W15K $\pm$ 5% SHAPED 7.5           | R954,R966,R946,R976,R977,R978,R940                                                    |
| 12  | CARBON-FILM RESISTOR   | 1/6W3.3K $\pm$ 5% SHAPED 7.5          | R948                                                                                  |
| 13  | CARBON-FILM RESISTOR   | 1/6W220K $\pm$ 5% SHAPED 7.5          | R962                                                                                  |
| 14  | CARBON-FILM RESISTOR   | 1/6W30K $\pm$ 5% SHAPED 7.5           | R936,R942                                                                             |
| 15  | CARBON-FILM RESISTOR   | 1/6W8.2K $\pm$ 5% SHAPED 7.5          | R937,R939,R934                                                                        |
| 16  | CARBON-FILM RESISTOR   | 1/2W100 $\Omega$ $\pm$ 5% SHAPED 12.5 | R915                                                                                  |
|     | CARBON-FILM RESISTOR   | 1/6W56K $\pm$ 5% SHAPED 7.5           | R908                                                                                  |
| 17  | CARBON-FILM RESISTOR   | 1/6W47 $\Omega$ $\pm$ 5% SHAPED 7.5   | R909                                                                                  |
| 18  | CARBON-FILM RESISTOR   | 1/6W470K $\pm$ 5% SHAPED 7.5          | R944                                                                                  |
| 19  | Rotating Potentiometer | A115NOED-H1B503-007                   | RP903,RP904                                                                           |
| 20  | Rotating Potentiometer | R1111NOA-V1C503FK00-01                | RP901,RP902                                                                           |
| 21  | Digital Potentiometer  | E1611A3A-V1FG05-01 WITH SPACER        | RP905                                                                                 |

