

## AUDIO PROCESSOR

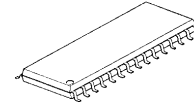
### ■ GENERAL DESCRIPTION

The **NJW1142** is a sound processor includes all of the functions required to process the audio signal for TV, such as tone control, balance, volume, mute, and AGC functions.

Also the **NJW1142** performs eala (NJRC Original Surround) which is regenerated 3D surround sound with only two speakers.

All of the internal status and variables are controlled by I<sup>2</sup>C BUS interface.

### ■ PACKAGE OUTLINE

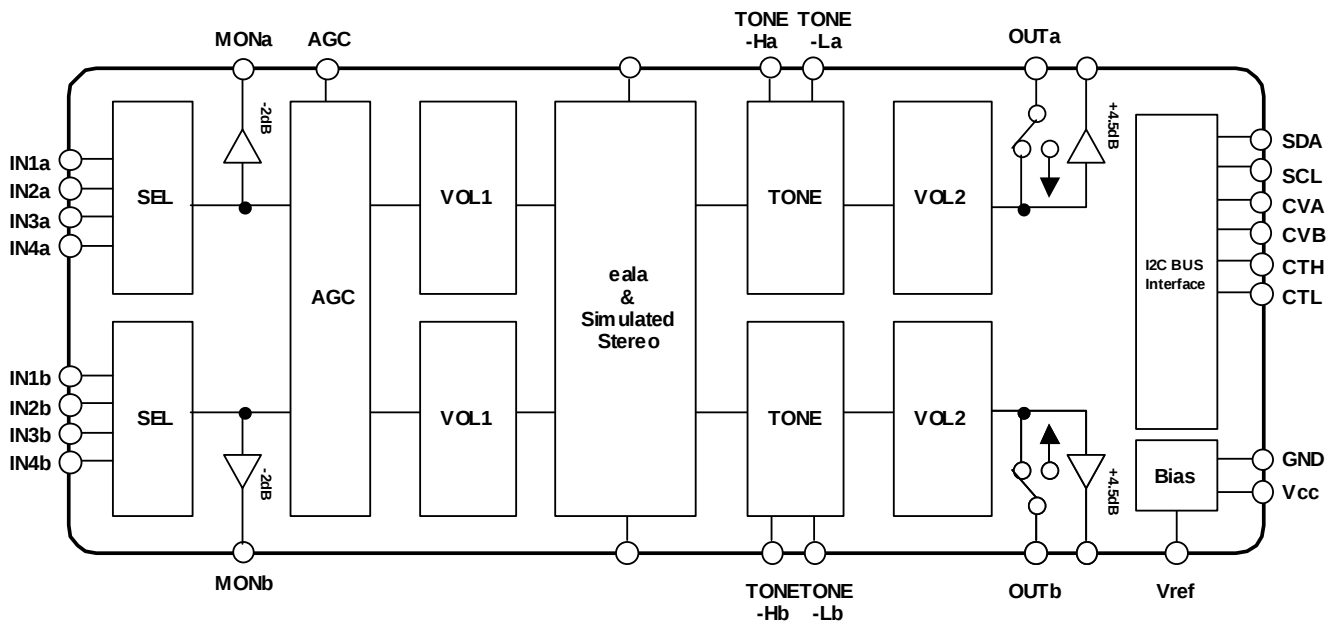


**NJW1142M**

### ■ FEATURES

- Operating Voltage 8 to 10V
- Internal 4 Input Audio Selectors and Monitor Output
- Low Noise VCA
- eala (NJRC Original Surround System)
- Simulated Stereo
- Variable AGC Compression Level via I<sup>2</sup>C (4-levels)
- Bi-CMOS Technology
- Package Outline SDMP30

### ■ BLOCK DIAGRAM



## ■ PIN CONFIGURATION



| No. | Symbol  | Function                              |    | Symbol  | Function                           |
|-----|---------|---------------------------------------|----|---------|------------------------------------|
| 1   | IN1a    | Ach Input1                            | 16 | V+      | Power Supply Pin                   |
| 2   | IN2a    | Ach Input2                            | 17 | Vref    | Reference Voltage                  |
| 3   | IN3a    | Ach Input3                            | 18 | CTL     | DAC Output for Tone Low Frequency  |
| 4   | IN4a    | Ach Input4                            | 19 | CTH     | DAC Output for Tone High Frequency |
| 5   | MONa    | Ach Monitor Output                    | 20 | AGC     | AGC Filter                         |
| 6   | SS FIL  | Surround Filter                       | 21 | OUTb    | Bch Output                         |
| 7   | TONE-Ha | Ach Treble Filter                     | 22 | LINEb   | Bch LINE Output(+4.5dB)            |
| 8   | TONE-La | Ach Bass Filter                       | 23 | TONE-Lb | Bch Bass Filter                    |
| 9   | LINEa   | Ach LINE Output(+4.5dB)               | 24 | TONE-Hb | Bch Treble Filter                  |
| 10  | OUTa    | Ach Output                            | 25 | SR FIL  | Surround Filter                    |
| 11  | CVA     | DAC Output for Ach Volume & Balance   | 26 | MONb    | Bch Monitor Output                 |
| 12  | CVB     | DAC Output for Bch Volume & Balance   | 27 | IN4b    | Bch Input4                         |
| 13  | SDA     | SDA Data Input (I <sup>2</sup> C BUS) | 28 | IN3b    | Bch Input3                         |
| 14  | SCL     | SCL Data Input (I <sup>2</sup> C BUS) | 29 | IN2b    | Bch Input2                         |
| 15  | GND     | GND                                   | 30 | IN1b    | Bch Input1                         |

## ■ ABSOLUTE MAXIMUM RATING (Ta=25°C)

| PARAMETER                   | SYMBOL         | RATING      | UNIT |
|-----------------------------|----------------|-------------|------|
| Supply Voltage              | V <sup>+</sup> | 12          | V    |
| Power Dissipation           | P <sub>D</sub> | 700         | mW   |
| Operating Temperature Range | Topr           | -20 to +75  | °C   |
| Storage Temperature Range   | Tstg           | -40 to +125 | °C   |

## ■ ELECTRICAL CHARACTERISTICS ( Ta=25°C, V<sup>+</sup>=9V, R<sub>g</sub>=600Ω, R<sub>L</sub>=47kΩ, Vin=100mVrms/1kHz)

| PARAMETER                 | SYMBOL             | TEST CONDITION                           | MIN. | TYP.          | MAX.          | UNIT           |
|---------------------------|--------------------|------------------------------------------|------|---------------|---------------|----------------|
| Operating Voltage         | V <sup>+</sup>     |                                          | 8.0  | 9.0           | 10.0          | V              |
| Supply Current            | I <sub>CC</sub>    | No Signal                                | -    | 30            | 50            | mA             |
| Reference Voltage         | V <sub>REF</sub>   | No Signal                                | 4.0  | 4.5           | 5.0           | V              |
| Maximum Input Voltage     | V <sub>IM</sub>    | VOL=-20dB, THD=3%                        | 2.8  | 3.0           | -             | Vrms           |
| Maximum Output Voltage1   | V <sub>OM1</sub>   | OUTPUT<br>VOL=0dB, THD=1%                | -    | 2.5           | -             | Vrms           |
| Maximum Output Voltage2   | V <sub>OM2</sub>   | LINEOUT<br>VOL=0dB, THD=1%               | -    | 2.5           | -             | Vrms           |
| MON OUT Gain              | G <sub>VMON</sub>  | MON OUT                                  | -    | -2.0          | -             | dB             |
| LINEOUT Gain              | G <sub>VLINE</sub> | LINEOUT, VOL=0dB                         | 2.5  | 4.5           | 6.5           | dB             |
| Maximum Gain              | G <sub>VMAX</sub>  | VOL=0dB                                  | -2.0 | 0.0           | 2.0           | dB             |
| Minimum Gain              | G <sub>VMIN</sub>  | VOL=Mute, Vin=1Vrms<br>BW=400Hz to 30kHz | -    | -             | -70           | dB             |
| Channel Balance           | G <sub>CB</sub>    | VOL=0dB                                  | -1.5 | 0.0           | 1.5           | dB             |
| Balance Boost A           | BA <sub>BST</sub>  | CHS="0",BAL="11111"                      | -2.0 | 0.0           | 2.0           | dB             |
| Balance Cut A             | BA <sub>CUT</sub>  | CHS="1",BAL="11111"<br>Vin = 1Vrms       | -    | -             | -70           | dB             |
| Balance Boost B           | BB <sub>BST</sub>  | CHS="1",BAL="11111"                      | -2.0 | 0.0           | 2.0           | dB             |
| Balance Cut B             | BB <sub>CUT</sub>  | CHS="0",BAL="11111"<br>Vin = 1Vrms       | -    | -             | -70           | dB             |
| Total Harmonic Distortion | THD                | Vo=0.5Vrms<br>BW=400Hz to 30kHz          | -    | -             | 0.5           | %              |
| Input Selector Cross Talk | CT                 | Vin=1Vrms<br>BW=400Hz to 30kHz           | -    | -             | -70           | dB             |
| Channel Separation        | CS                 | Vin=1Vrms<br>BW=400Hz to 30kHz           | -    | -             | -70           | dB             |
| Output Noise 1            | V <sub>NO1</sub>   | VOL=0dB<br>BW=400Hz to 30kHz             | -    | -90<br>(31.6) | -85<br>(56.2) | dBV<br>(μVrms) |
| Output Noise 2            | V <sub>NO2</sub>   | VOL=Mute<br>BW=400Hz to 30kHz            | -    | -106<br>(5.0) | -96<br>(15.8) | dBV<br>(μVrms) |
| Output Noise 3            | V <sub>NO3</sub>   | LINEOUT, VOL=0dB<br>BW=400Hz to 30kHz    | -    | -85<br>(56.2) | -80<br>(100)  | dBV<br>(μVrms) |
| Output Noise 4            | V <sub>NO4</sub>   | LINEOUT, VOL=Mute<br>BW=400Hz to 30kHz   | -    | -101<br>(8.9) | -91<br>(28.2) | dBV<br>(μVrms) |

## ■ ELECTRICAL CHARACTERISTICS ( Ta=25°C, V<sup>+</sup>=9V, R<sub>g</sub>=600Ω, R<sub>L</sub>=47kΩ, Vin=100mVrms/1kHz)

### ● TONE CONTROL (Tone Control-ON)

| PARAMETER            | SYMBOL            | TEST CONDITION        | MIN.  | TYP.  | MAX.  | UNIT |
|----------------------|-------------------|-----------------------|-------|-------|-------|------|
| High Frequency Boost | HF <sub>BST</sub> | TREBLE=+15dB, f=10kHz | 12.5  | 15.0  | 17.5  | dB   |
| High Frequency Flat  | HF <sub>FLT</sub> | TRBE=0dB, f=10kHz     | -2.0  | 0.0   | 2.0   | dB   |
| High Frequency Cut   | HF <sub>CUT</sub> | TREBLE=-15dB, f=10kHz | -17.5 | -15.0 | -12.5 | dB   |
| Low Frequency Boost  | LF <sub>BST</sub> | BASS=+15dB, f=100Hz   | 12.5  | 15.0  | 17.5  | dB   |
| Low Frequency Flat   | LF <sub>FLT</sub> | BASS=0dB, f=100Hz     | -2.0  | 0.0   | 2.0   | dB   |
| Low Frequency Cut    | LF <sub>CUT</sub> | BASS=-15dB, f=100Hz   | -17.5 | -15.0 | -12.5 | dB   |

### ● SUB-TONE CONTROL (Sub-Tone Control-ON)

| PARAMETER            | SYMBOL             | TEST CONDITION           | MIN. | TYP. | MAX. | UNIT |
|----------------------|--------------------|--------------------------|------|------|------|------|
| High Frequency Boost | SHF <sub>BST</sub> | SUB-TREBLE=+3dB, f=10kHz | 2.0  | 3.0  | 4.0  | dB   |
| High Frequency Flat  | SHF <sub>FLT</sub> | SUB-TREBLE=0dB, f=10kHz  | -2.0 | 0.0  | 2.0  | dB   |
| High Frequency Cut   | SHF <sub>CUT</sub> | SUB-TREBLE=-3dB, f=10kHz | -4.0 | -3.0 | -2.0 | dB   |
| Low Frequency Boost  | SLF <sub>BST</sub> | SUB-BASS=+3dB, f=100Hz   | 2.0  | 3.0  | 4.0  | dB   |
| Low Frequency Flat   | SLF <sub>FLT</sub> | SUB-BASS=0dB, f=100Hz    | -2.0 | 0.0  | 2.0  | dB   |
| Low Frequency Cut    | SLF <sub>CUT</sub> | SUB-BASS=-3dB, f=100Hz   | -4.0 | -3.0 | -2.0 | dB   |

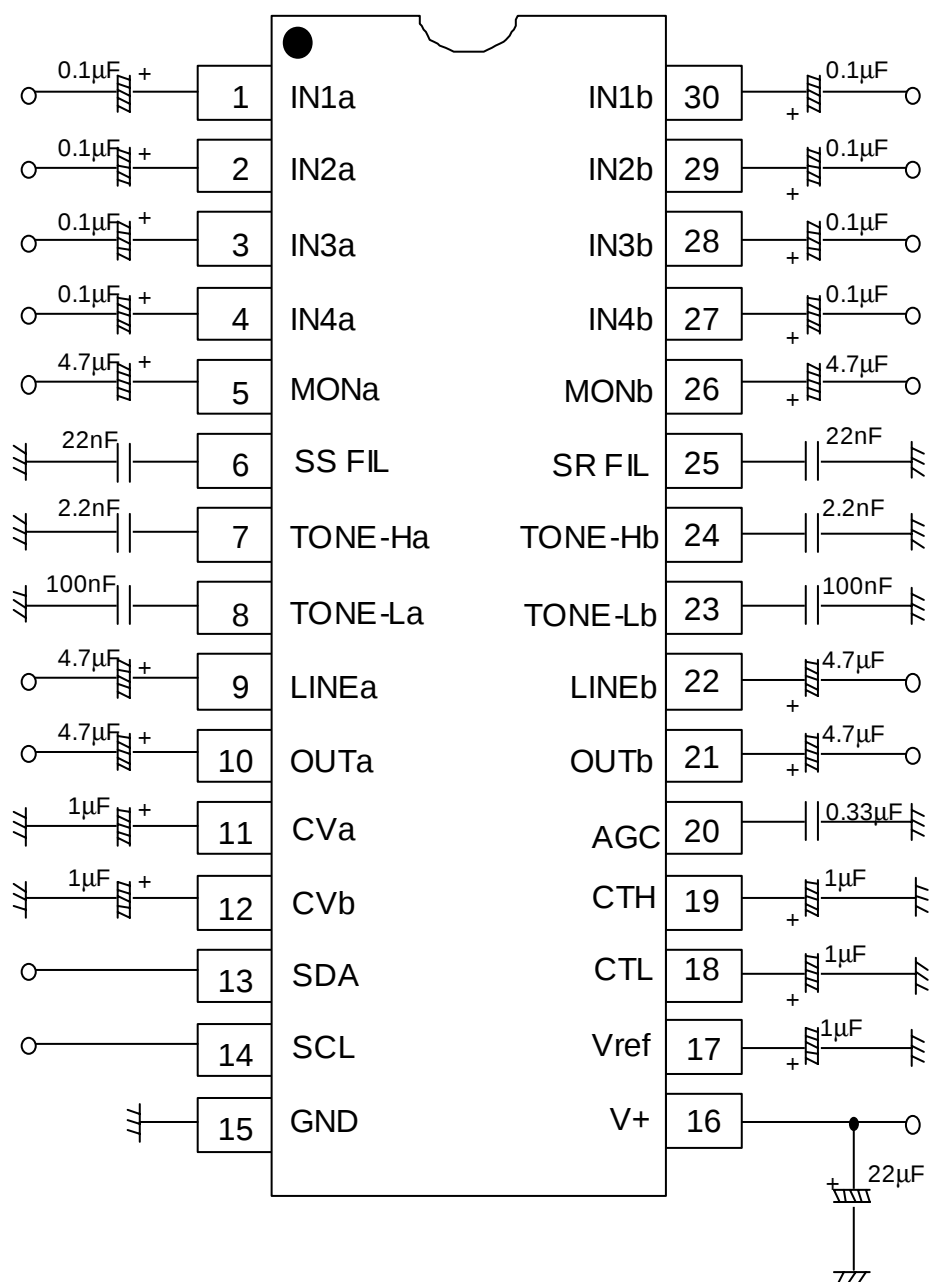
### ● AGC (AGC-ON)

| PARAMETER  | SYMBOL              | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|------------|---------------------|----------------|------|------|------|------|
| AGC BOOST  | AGC <sub>BST</sub>  | Vin=50mVrms    | 1.5  | 3.5  | 5.5  | dB   |
| AGC FLAT 1 | AGC <sub>FLT1</sub> | Vin=300mVrms   | -2.5 | 0.0  | 2.5  | dB   |
| AGC FLAT 2 | AGC <sub>FLT2</sub> | Vin=400mVrms   | -2.5 | 0.0  | 2.5  | dB   |
| AGC FLAT 3 | AGC <sub>FLT3</sub> | Vin=500mVrms   | -2.5 | 0.0  | 2.5  | dB   |
| AGC FLAT 4 | AGC <sub>FLT4</sub> | Vin=600mVrms   | -2.5 | 0.0  | 2.5  | dB   |
| AGC CUT    | AGC <sub>CUT</sub>  | Vin=2Vrms      | -14  | -10  | -6.0 | dB   |

### ● SURROUND (SURROUND-ON)

| PARAMETER          | SYMBOL             | TEST CONDITION         | MIN. | TYP. | MAX. | UNIT |
|--------------------|--------------------|------------------------|------|------|------|------|
| Simulated Stereo A | SR <sub>SIMA</sub> | Ain+Bin → Aout, f=1kHz | 1.0  | 3.0  | 5.0  | dB   |
| Simulated Stereo B | SR <sub>SIMB</sub> | Ain+Bin → Bout, f=1kHz | 1.0  | 3.0  | 5.0  | dB   |
| Surround 3D1       | SR <sub>3D1</sub>  | Ain → Aout, f=100Hz    | 8.0  | 10.0 | 12.0 | dB   |
| Surround 3D2       | SR <sub>3D2</sub>  | Ain → Aout, f=10kHz    | -2.0 | 0.0  | 2.0  | dB   |
| Surround 3D3       | SR <sub>3D3</sub>  | Ain → Bout, f=100Hz    | 4.5  | 6.5  | 8.5  | dB   |

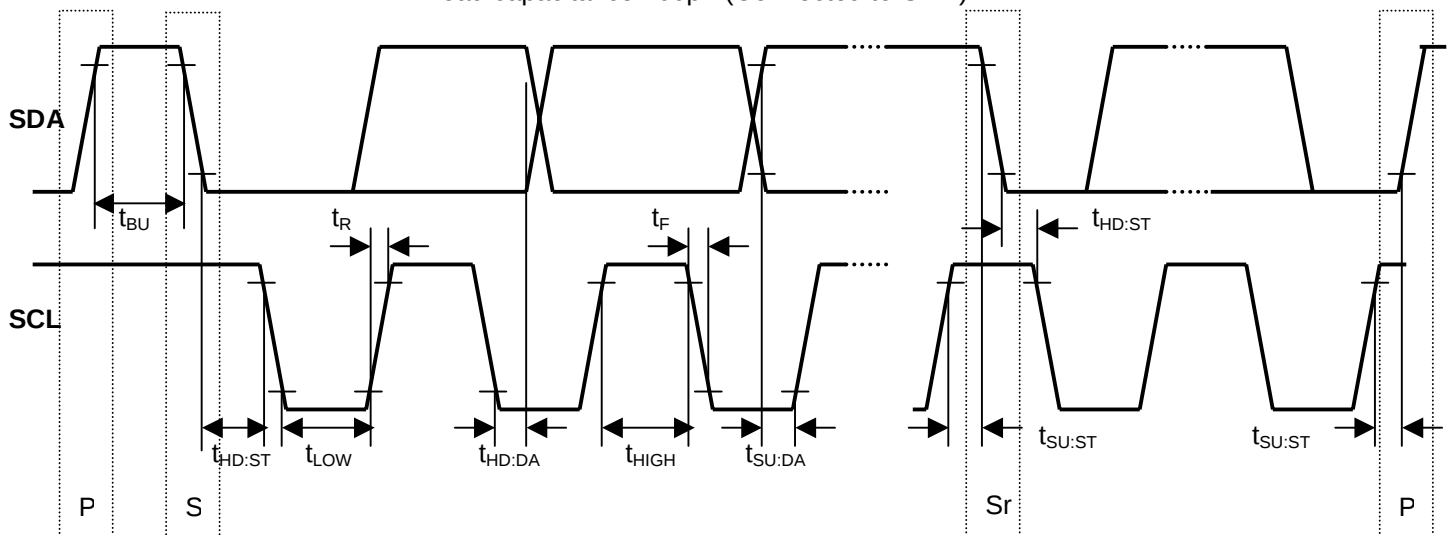
## ■ APPLICATION CIRCUIT



## ■ I<sup>2</sup>C BUS BLOCK CHARACTERISTICS (SDA,SCL)

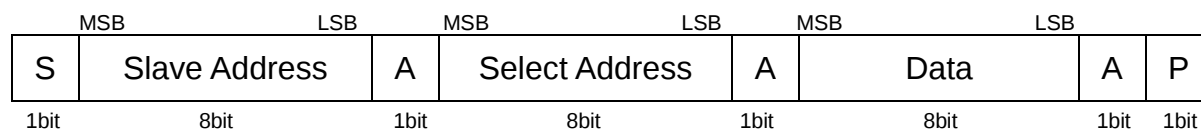
| PARAMETER                                 | SYMBOL              | MIN. | TYP. | MAX. | UNIT |
|-------------------------------------------|---------------------|------|------|------|------|
| High Level Input Voltage                  | V <sub>IH</sub>     | 3.0  | -    | 5.0  | V    |
| Low Level Input Voltage                   | V <sub>IL</sub>     | 0    | -    | 1.5  | V    |
| High Level Input Current                  | I <sub>IH</sub>     | -    | -    | 10   | μA   |
| Low Level Input Current                   | I <sub>IL</sub>     | -    | -    | 10   | μA   |
| Low Level Output Voltage (3mA at SDA pin) | V <sub>OL</sub>     | 0    | -    | 0.4  | V    |
| Maximum Output Current                    | I <sub>OL</sub>     | -3.0 | -    | -    | mA   |
| Maximum Clock Frequency                   | f <sub>SCL</sub>    | 0    | -    | 100  | kHz  |
| Data Change Minimum Waiting Time          | t <sub>BUF</sub>    | 4.7  | -    | -    | μs   |
| Data Transfer Start Minimum Waiting Time  | t <sub>HD:STA</sub> | 4.0  | -    | -    | μs   |
| Low Level Clock Pulse Width               | t <sub>LOW</sub>    | 4.7  | -    | -    | μs   |
| High Level Clock Pulse Width              | T <sub>HIGH</sub>   | 4.0  | -    | -    | μs   |
| Minimum Start Preparation Waiting Time    | t <sub>SU:STA</sub> | 4.7  | -    | -    | μs   |
| Minimum Data Hold Time                    | t <sub>HD:DAT</sub> | 5.0  | -    | -    | μs   |
| Minimum Data Preparation Time             | t <sub>SU:DAT</sub> | 250  | -    | -    | ns   |
| Rise Time                                 | t <sub>R</sub>      | -    | -    | 1.0  | μs   |
| Fall Time                                 | t <sub>F</sub>      | -    | -    | 300  | ns   |
| Minimum Stop Preparation Waiting Time     | t <sub>SU:STO</sub> | 4.7  | -    | -    | μs   |

I<sup>2</sup>C BUS Load Condition: Pull up resistance 4kΩ (Connected to +5V)  
Load capacitance 200pF (Connected to GND)



## ■ DEFINITION OF I<sup>2</sup>C REGISTER

### ◆ I<sup>2</sup>C BUS FORMAT



S: Starting Term

A: Acknowledge Bit

P: Ending Term

### ◆ SLAVE ADDRESS

|     |   |   |   |   |   |   |     |
|-----|---|---|---|---|---|---|-----|
| MSB |   |   |   |   |   |   | LSB |
| 1   | 0 | 0 | 0 | 0 | 0 | 1 | R/W |

R/W=0: Receive Only

R/W=1: No Output Data

### ◆ CONTROL REGISTER TABLE

The select address sets each function (Volume, Balance, AGC, Surround, Tone Control, AUX).

The auto increment function cycles the select address as follows.

00H→01H→02H→03H→04H→05H→00H

| Select Address | BIT        |      |    |    |      |      |          |            |
|----------------|------------|------|----|----|------|------|----------|------------|
|                | D7         | D6   | D5 | D4 | D3   | D2   | D1       | D0         |
| 00H            | VOL        |      |    |    |      |      |          |            |
| 01H            | CHS        | BAL  |    |    |      |      | SUR1     | SUR0       |
| 02H            | BCB        | BASS |    |    |      | BCSB | SUB-BASS |            |
| 03H            | BCT        | TREB |    |    |      | BCST | SUB-TREB |            |
| 04H            | Don't Care |      |    |    |      |      |          |            |
| 05H            | OUT        | SEL  |    |    | AGC1 | AGC0 | AGC      | Don't Care |

### ◆ CONTROL REGISTER DEFAULT VALUE

Control register default value is all "0".

| Select Address | BIT |    |    |    |    |    |    |    |
|----------------|-----|----|----|----|----|----|----|----|
|                | D7  | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 00H            | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| 01H            | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| 02H            | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| 03H            | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| 04H            | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| 05H            | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |

## ■INSTRUCTION CODE

### a) MASTER VOLUME SETTING

| Select Address | BIT |    |    |    |    |    |    |    |
|----------------|-----|----|----|----|----|----|----|----|
|                | D7  | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 00H            | VOL |    |    |    |    |    |    |    |

The volume control for both Ach and Bch(0.33dB/step).

The volume is consisted of volume1 and volume2 and the level is divided into half to each volume1 and volume2.

### b) BALANCE, AGC AND SURROUND SETTING

| Select Address | BIT |     |    |    |    |    |     |     |
|----------------|-----|-----|----|----|----|----|-----|-----|
|                | D7  | D6  | D5 | D4 | D3 | D2 | D1  | D0  |
| 01H            | CHS | BAL |    |    |    |    | SR1 | SR0 |

- CHS : Channel select for balance control

“0” : Ach “Bch is attenuated”

“1” : Bch “Ach is attenuated”

- BAL : Balance control for both Ach and Bch(1dB/Step)

The balance is consisted of volume1 and volume2 and the level is divided into half to each volume1 and volume2.

- “SR1”, “SR0” : Surround Mode select

| Surround Mode        | SR1<br>(D1) | SR0<br>(D0) |
|----------------------|-------------|-------------|
| Surround Off(Bypass) | 0           | 0           |
| Simulated Stereo     | 0           | 1           |
| eala effect large    | 1           | 0           |
| eala effect small    | 1           | 1           |

### c)TONE CONTROL BASS SETTING

| Select Address | BIT |      |    |    |    |      |          |    |
|----------------|-----|------|----|----|----|------|----------|----|
|                | D7  | D6   | D5 | D4 | D3 | D2   | D1       | D0 |
| 02H            | BCB | BASS |    |    |    | BCSB | SUB-BASS |    |

- BCB : Boost cut select for Bass control

“0” : Cut

“1” : Boost

- BASS: BASS control

Cut Level : -15dB to 0dB(1dB/Step)

Boost Level : 0dB to +15dB(1dB/Step)

- BCSB : Boost cut select for SUB-BASS control

“0” : Cut

“1” : Boost

- SUB-BASS: SUB- BASS control(1dB/Step)

Sub-Cut Level : -3dB to 0dB(1dB/Step)

Sub-Boost Level : 0dB to +3dB(1dB/Step)

## d) TONE CONTROL TREBLE SETTING

| Select Address | BIT |      |    |    |    |      |          |    |
|----------------|-----|------|----|----|----|------|----------|----|
|                | D7  | D6   | D5 | D4 | D3 | D2   | D1       | D0 |
| 03H            | BCT | TREB |    |    |    | BCST | SUB-TREB |    |

- BCT : Boost cut select for Treble control  
     "0" : Cut  
     "1" : Boost
- TREB: Treble control(1dB/step)  
     Cut Level : -15dB to 0dB(1dB/Step)  
     Boost Level : 0dB to +15dB(1dB/Step)
- BCST : Boost cut select for Sub-Treble control  
     "0" : Cut  
     "1" : Boost
- SUB-TREB: Sub-Treble control(1dB/step)  
     Sub-Cut Level : -3dB to 0dB(1dB/Step)  
     Sub-Boost Level : 0dB to +3dB(1dB/Step)

## e) OUTPUT AND AUXILIARY SETTING

| Select Address | BIT |     |    |    |      |      |     |            |
|----------------|-----|-----|----|----|------|------|-----|------------|
|                | D7  | D6  | D5 | D4 | D3   | D2   | D1  | D0         |
| 05H            | OUT | SEL |    |    | AGC1 | AGC0 | AGC | Don't Care |

- OUT: ON/OFF Switch for OUTPUT  
     "0" : OFF(MUTE)  
     "1" : ON

- SEL: Input Selector

| Input Channel Selector | SEL |    |    |
|------------------------|-----|----|----|
|                        | D6  | D5 | D4 |
| 1                      | 0   | 1  | 0  |
| 2                      | 0   | 1  | 1  |
| 3                      | 1   | 0  | 0  |
| 4                      | 1   | 0  | 1  |

- AGC1: AGC Level Setting

| AGC Level | AGC1(D3) | AGC0(D2) | AGC (D1) |
|-----------|----------|----------|----------|
| 300mVrms  | 0        | 0        | 1        |
| 400mVrms  | 0        | 1        | 1        |
| 500mVrms  | 1        | 0        | 1        |
| 600mVrms  | 1        | 1        | 1        |
| AGC Off   | *        | *        | 0        |

\* Don't Care

## ■MASTER VOLUME (Select Address : 00H)

| Gain(dB) | HEX | VOL |    |    |    |    |    |    |    |
|----------|-----|-----|----|----|----|----|----|----|----|
|          |     | D7  | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 0        | FF  | 1   | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| -1       | FC  | 1   | 1  | 1  | 1  | 1  | 1  | 0  | 0  |
| -2       | F9  | 1   | 1  | 1  | 1  | 1  | 0  | 0  | 1  |
| -3       | F6  | 1   | 1  | 1  | 1  | 0  | 1  | 1  | 0  |
| -4       | F3  | 1   | 1  | 1  | 1  | 0  | 0  | 1  | 1  |
| -5       | F0  | 1   | 1  | 1  | 1  | 0  | 0  | 0  | 0  |
| -6       | ED  | 1   | 1  | 1  | 0  | 1  | 1  | 0  | 1  |
| -7       | EA  | 1   | 1  | 1  | 0  | 1  | 0  | 1  | 0  |
| -8       | E7  | 1   | 1  | 1  | 0  | 0  | 1  | 1  | 1  |
| -9       | E4  | 1   | 1  | 1  | 0  | 0  | 1  | 0  | 0  |
| -10      | E1  | 1   | 1  | 1  | 0  | 0  | 0  | 0  | 1  |
| -11      | DE  | 1   | 1  | 0  | 1  | 1  | 1  | 1  | 0  |
| -12      | DB  | 1   | 1  | 0  | 1  | 1  | 0  | 1  | 1  |
| -13      | D8  | 1   | 1  | 0  | 1  | 1  | 0  | 0  | 0  |
| -14      | D5  | 1   | 1  | 0  | 1  | 0  | 1  | 0  | 1  |
| -15      | D2  | 1   | 1  | 0  | 1  | 0  | 0  | 1  | 0  |
| -16      | CF  | 1   | 1  | 0  | 0  | 1  | 1  | 1  | 1  |
| -17      | CC  | 1   | 1  | 0  | 0  | 1  | 1  | 0  | 0  |
| -18      | C9  | 1   | 1  | 0  | 0  | 1  | 0  | 0  | 1  |
| -19      | C6  | 1   | 1  | 0  | 0  | 0  | 1  | 1  | 0  |
| -20      | C3  | 1   | 1  | 0  | 0  | 0  | 0  | 1  | 1  |
| -21      | C0  | 1   | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| -22      | BD  | 1   | 0  | 1  | 1  | 1  | 1  | 0  | 1  |
| -23      | BA  | 1   | 0  | 1  | 1  | 1  | 0  | 1  | 0  |
| -24      | B7  | 1   | 0  | 1  | 1  | 0  | 1  | 1  | 1  |
| -25      | B4  | 1   | 0  | 1  | 1  | 0  | 1  | 0  | 0  |
| -26      | B1  | 1   | 0  | 1  | 1  | 0  | 0  | 0  | 1  |
| -27      | AE  | 1   | 0  | 1  | 0  | 1  | 1  | 1  | 0  |
| -28      | AB  | 1   | 0  | 1  | 0  | 1  | 0  | 1  | 1  |
| -29      | A8  | 1   | 0  | 1  | 0  | 1  | 0  | 0  | 0  |
| -30      | A5  | 1   | 0  | 1  | 0  | 0  | 1  | 0  | 1  |
| -31      | A2  | 1   | 0  | 1  | 0  | 0  | 0  | 1  | 0  |
| -32      | 9F  | 1   | 0  | 0  | 1  | 1  | 1  | 1  | 1  |
| -33      | 9C  | 1   | 0  | 0  | 1  | 1  | 1  | 0  | 0  |
| -34      | 99  | 1   | 0  | 0  | 1  | 1  | 0  | 0  | 1  |
| -35      | 96  | 1   | 0  | 0  | 1  | 0  | 1  | 1  | 0  |
| -36      | 93  | 1   | 0  | 0  | 1  | 0  | 0  | 1  | 1  |
| -37      | 90  | 1   | 0  | 0  | 1  | 0  | 0  | 0  | 0  |
| -38      | 8D  | 1   | 0  | 0  | 0  | 1  | 1  | 0  | 1  |
| -39      | 8A  | 1   | 0  | 0  | 0  | 1  | 0  | 1  | 0  |
| -40      | 87  | 1   | 0  | 0  | 0  | 0  | 1  | 1  | 1  |
| -41      | 84  | 1   | 0  | 0  | 0  | 0  | 1  | 0  | 0  |
| -42      | 81  | 1   | 0  | 0  | 0  | 0  | 0  | 0  | 1  |

## ■MASTER VOLUME (Select Address : 00H)

| Gain(dB) | HEX | VOL |    |    |    |    |    |    |    |
|----------|-----|-----|----|----|----|----|----|----|----|
|          |     | D7  | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| -43      | 7E  | 0   | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
| -44      | 7B  | 0   | 1  | 1  | 1  | 1  | 0  | 1  | 1  |
| -45      | 78  | 0   | 1  | 1  | 1  | 1  | 0  | 0  | 0  |
| -46      | 75  | 0   | 1  | 1  | 1  | 0  | 1  | 0  | 1  |
| -47      | 72  | 0   | 1  | 1  | 1  | 0  | 0  | 1  | 0  |
| -48      | 6F  | 0   | 1  | 1  | 0  | 1  | 1  | 1  | 1  |
| -49      | 6C  | 0   | 1  | 1  | 0  | 1  | 1  | 0  | 0  |
| -50      | 69  | 0   | 1  | 1  | 0  | 1  | 0  | 0  | 1  |
| -51      | 66  | 0   | 1  | 1  | 0  | 0  | 1  | 1  | 0  |
| -52      | 63  | 0   | 1  | 1  | 0  | 0  | 0  | 1  | 1  |
| -53      | 60  | 0   | 1  | 1  | 0  | 0  | 0  | 0  | 0  |
| -54      | 5D  | 0   | 1  | 0  | 1  | 1  | 1  | 0  | 1  |
| -55      | 5A  | 0   | 1  | 0  | 1  | 1  | 0  | 1  | 0  |
| -56      | 57  | 0   | 1  | 0  | 1  | 0  | 1  | 1  | 1  |
| -57      | 54  | 0   | 1  | 0  | 1  | 0  | 1  | 0  | 0  |
| -58      | 51  | 0   | 1  | 0  | 1  | 0  | 0  | 0  | 1  |
| -59      | 4E  | 0   | 1  | 0  | 0  | 1  | 1  | 1  | 0  |
| -60      | 4B  | 0   | 1  | 0  | 0  | 1  | 0  | 1  | 1  |
| -61      | 48  | 0   | 1  | 0  | 0  | 1  | 0  | 0  | 0  |
| -62      | 45  | 0   | 1  | 0  | 0  | 0  | 1  | 0  | 1  |
| -63      | 42  | 0   | 1  | 0  | 0  | 0  | 0  | 1  | 0  |
| -64      | 3F  | 0   | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
| -65      | 3C  | 0   | 0  | 1  | 1  | 1  | 1  | 0  | 0  |
| -66      | 39  | 0   | 0  | 1  | 1  | 1  | 0  | 0  | 1  |
| -67      | 36  | 0   | 0  | 1  | 1  | 0  | 1  | 1  | 0  |
| -68      | 33  | 0   | 0  | 1  | 1  | 0  | 0  | 1  | 1  |
| -69      | 30  | 0   | 0  | 1  | 1  | 0  | 0  | 0  | 0  |
| -70      | 2D  | 0   | 0  | 1  | 0  | 1  | 1  | 0  | 1  |
| -71      | 2A  | 0   | 0  | 1  | 0  | 1  | 0  | 1  | 0  |
| -72      | 27  | 0   | 0  | 1  | 0  | 0  | 1  | 1  | 1  |
| -73      | 24  | 0   | 0  | 1  | 0  | 0  | 1  | 0  | 0  |
| -74      | 21  | 0   | 0  | 1  | 0  | 0  | 0  | 0  | 1  |
| -75      | 1E  | 0   | 0  | 0  | 1  | 1  | 1  | 1  | 0  |
| -76      | 1B  | 0   | 0  | 0  | 1  | 1  | 0  | 1  | 1  |
| -77      | 18  | 0   | 0  | 0  | 1  | 1  | 0  | 0  | 0  |
| -78      | 15  | 0   | 0  | 0  | 1  | 0  | 1  | 0  | 1  |
| -79      | 12  | 0   | 0  | 0  | 1  | 0  | 0  | 1  | 0  |
| -80      | 0F  | 0   | 0  | 0  | 0  | 1  | 1  | 1  | 1  |
| -81      | 0C  | 0   | 0  | 0  | 0  | 1  | 1  | 0  | 0  |
| -82      | 09  | 0   | 0  | 0  | 0  | 1  | 0  | 0  | 1  |
| -83      | 06  | 0   | 0  | 0  | 0  | 0  | 1  | 1  | 0  |
| -84      | 03  | 0   | 0  | 0  | 0  | 0  | 0  | 1  | 1  |
| Mute     | 00  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |

## ■BALANCE(Select Address : 01H)

| Channel<br>Select (CHS) | D7 |
|-------------------------|----|
| Ach(Bch is attenuated)  | 0  |
| Bch(Ach is attenuated)  | 1  |

|          | BAL |    |    |    |    |
|----------|-----|----|----|----|----|
| Gain(dB) | D6  | D5 | D4 | D3 | D2 |
| 0        | 0   | 0  | 0  | 0  | 0  |
| -1       | 0   | 0  | 0  | 0  | 1  |
| -2       | 0   | 0  | 0  | 1  | 0  |
| -3       | 0   | 0  | 0  | 1  | 1  |
| -4       | 0   | 0  | 1  | 0  | 0  |
| -5       | 0   | 0  | 1  | 0  | 1  |
| -6       | 0   | 0  | 1  | 1  | 0  |
| -7       | 0   | 0  | 1  | 1  | 1  |
| -8       | 0   | 1  | 0  | 0  | 0  |
| -9       | 0   | 1  | 0  | 0  | 1  |
| -10      | 0   | 1  | 0  | 1  | 0  |
| -11      | 0   | 1  | 0  | 1  | 1  |
| -12      | 0   | 1  | 1  | 0  | 0  |
| -13      | 0   | 1  | 1  | 0  | 1  |
| -14      | 0   | 1  | 1  | 1  | 0  |
| -15      | 0   | 1  | 1  | 1  | 1  |
| -16      | 1   | 0  | 0  | 0  | 0  |
| -17      | 1   | 0  | 0  | 0  | 1  |
| -18      | 1   | 0  | 0  | 1  | 0  |
| -19      | 1   | 0  | 0  | 1  | 1  |
| -20      | 1   | 0  | 1  | 0  | 0  |
| -21      | 1   | 0  | 1  | 0  | 1  |
| -22      | 1   | 0  | 1  | 1  | 0  |
| -23      | 1   | 0  | 1  | 1  | 1  |
| -24      | 1   | 1  | 0  | 0  | 0  |
| -25      | 1   | 1  | 0  | 0  | 1  |
| -26      | 1   | 1  | 0  | 1  | 0  |
| -27      | 1   | 1  | 0  | 1  | 1  |
| -28      | 1   | 1  | 1  | 0  | 0  |
| -29      | 1   | 1  | 1  | 0  | 1  |
| -30      | 1   | 1  | 1  | 1  | 0  |
| Mute     | 1   | 1  | 1  | 1  | 1  |

## ■TONE CONTROL BASS (Select Address : 02H)

| Bass<br>Cut or Boost | BCB |
|----------------------|-----|
|                      | D7  |
| Cut                  | 0   |
| Boost                | 1   |

|     |    | BASS |    |    |    |
|-----|----|------|----|----|----|
|     |    | D6   | D5 | D4 | D3 |
| -15 | 15 | 1    | 1  | 1  | 1  |
| -14 | 14 | 1    | 1  | 1  | 0  |
| -13 | 13 | 1    | 1  | 0  | 1  |
| -12 | 12 | 1    | 1  | 0  | 0  |
| -11 | 11 | 1    | 0  | 1  | 1  |
| -10 | 10 | 1    | 0  | 1  | 0  |
| -9  | 9  | 1    | 0  | 0  | 1  |
| -8  | 8  | 1    | 0  | 0  | 0  |
| -7  | 7  | 0    | 1  | 1  | 1  |
| -6  | 6  | 0    | 1  | 1  | 0  |
| -5  | 5  | 0    | 1  | 0  | 1  |
| -4  | 4  | 0    | 1  | 0  | 0  |
| -3  | 3  | 0    | 0  | 1  | 1  |
| -2  | 2  | 0    | 0  | 1  | 0  |
| -1  | 1  | 0    | 0  | 0  | 1  |
| 0   | 0  | 0    | 0  | 0  | 0  |

## ■TONE CONTROL SUB-BASS (Select Address : 02H)

| Sub-Bass<br>Cut or Boost | BCSB |
|--------------------------|------|
|                          | D2   |
| Cut                      | 0    |
| Boost                    | 1    |

|    |   | SUB-BASS |    |
|----|---|----------|----|
|    |   | D1       | D0 |
| -3 | 3 | 1        | 1  |
| -2 | 2 | 1        | 0  |
| -1 | 1 | 0        | 1  |
| 0  | 0 | 0        | 0  |

## ■TONE CONTROL TREBLE (Select Address : 03H)

| Treble<br>Cut or Boost | BCT |
|------------------------|-----|
|                        | D7  |
| Cut                    | 0   |
| Boost                  | 1   |

|              |                | TREB |    |    |    |
|--------------|----------------|------|----|----|----|
| Cut Gain(dB) | Boost Gain(dB) | D6   | D5 | D4 | D3 |
| -15          | 15             | 1    | 1  | 1  | 1  |
| -14          | 14             | 1    | 1  | 1  | 0  |
| -13          | 13             | 1    | 1  | 0  | 1  |
| -12          | 12             | 1    | 1  | 0  | 0  |
| -11          | 11             | 1    | 0  | 1  | 1  |
| -10          | 10             | 1    | 0  | 1  | 0  |
| -9           | 9              | 1    | 0  | 0  | 1  |
| -8           | 8              | 1    | 0  | 0  | 0  |
| -7           | 7              | 0    | 1  | 1  | 1  |
| -6           | 6              | 0    | 1  | 1  | 0  |
| -5           | 5              | 0    | 1  | 0  | 1  |
| -4           | 4              | 0    | 1  | 0  | 0  |
| -3           | 3              | 0    | 0  | 1  | 1  |
| -2           | 2              | 0    | 0  | 1  | 0  |
| -1           | 1              | 0    | 0  | 0  | 1  |
| 0            | 0              | 0    | 0  | 0  | 0  |

## ■TONE CONTROL SUB-TREBLE (Select Address : 03H)

| Sub-Treble<br>Cut or Boost | BCST |
|----------------------------|------|
|                            | D2   |
| Cut                        | 0    |
| Boost                      | 1    |

|              |                | SUB-TREB |    |
|--------------|----------------|----------|----|
| Cut Gain(dB) | Boost Gain(dB) | D1       | D1 |
| -3           | 3              | 1        | 1  |
| -2           | 2              | 1        | 0  |
| -1           | 1              | 0        | 1  |
| 0            | 0              | 0        | 0  |

## ■NOTE

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