

## AUDIO PROCESSOR

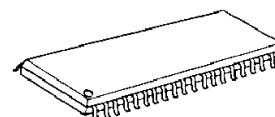
## ■ GENERAL DESCRIPTION

The **NJW1135** is a audio processor with sound enhancement (BBE). It includes all of the functions processing audio signal for TV, such as tone control, balance, volume, mute, and AGC functions.

Also the **NJW1135** performs surround and sound enhancement. The sound enhancement regenerates high definitive and nearly real sound.

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

## ■ PACKAGE OUTLINE

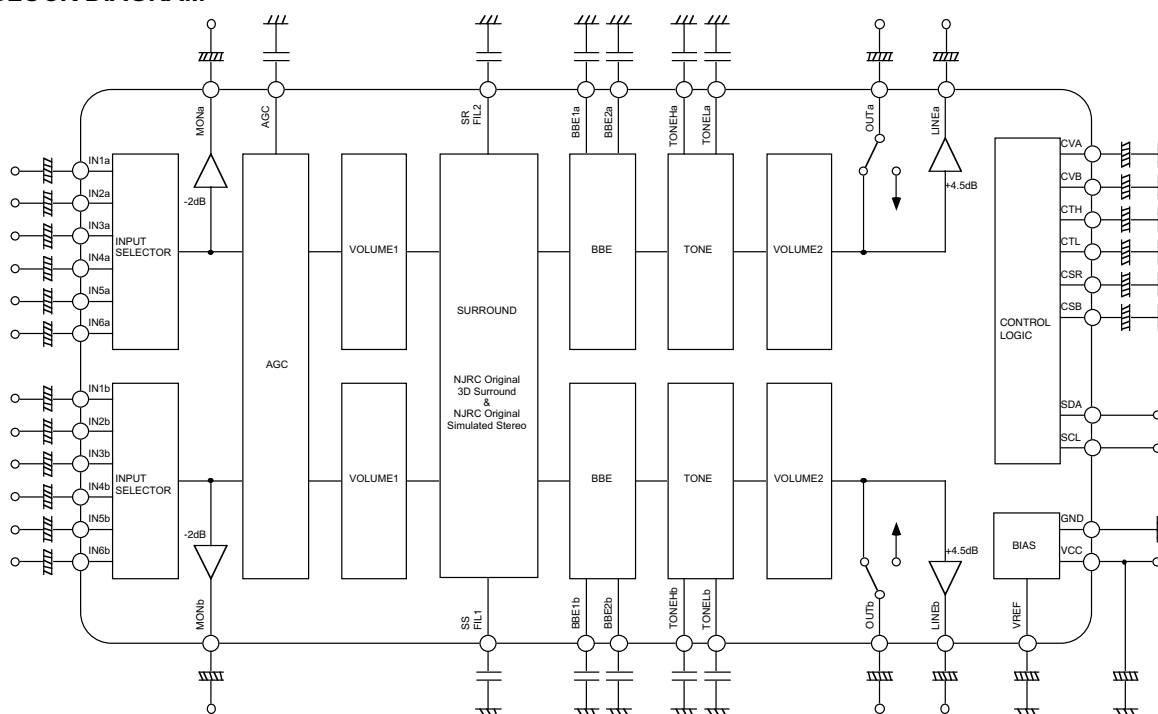


NJW1135G

## ■ FEATURES

- Operating Voltage (8 to 13V)
- I<sup>2</sup>C BUS Interface
- BBE Sound Enhancement (Low Boost and High Boost: 15dB max.)
- Internal 6 Input Audio Selectors and Monitor Output
- The AGC circuit reduces volume difference among input sources.
- Variable AGC Compression Level via I<sup>2</sup>C (4-levels)
- NJRC Original Surround (NJRC Original 3D Surround and Simulated Surround)
- Variable Surround Effect Level via I<sup>2</sup>C (3D Surround mode, 2-Levels)
- Low Noise VCA
- Bi-CMOS Technology
- Package Outline (SOP40)

## ■ BLOCK DIAGRAM



## ■ PIN CONFIGURATION

|                                     |    |         |         |    |                                    |
|-------------------------------------|----|---------|---------|----|------------------------------------|
| Ach Input Selector 1                | 1  | IN1a    | IN1b    | 40 | Bch Input Selector 1               |
| Ach Input Selector 2                | 2  | IN2a    | IN2b    | 39 | Bch Input Selector 2               |
| Ach Input Selector 3                | 3  | IN3a    | IN3b    | 38 | Bch Input Selector 3               |
| Ach Input Selector 4                | 4  | IN4a    | IN4b    | 37 | Bch Input Selector 4               |
| Ach Input Selector 5                | 5  | IN5a    | IN5b    | 36 | Bch Input Selector 5               |
| Ach Input Selector 6                | 6  | IN6a    | IN6b    | 35 | Bch Input Selector 6               |
| Ach Monitor Output(-2dB)            | 7  | MONa    | MONb    | 34 | Bch Monitor Output(-2dB)           |
| Surround Filter 1                   | 8  | SS FIL1 | SR FIL2 | 33 | Surround Filter 2                  |
| Ach BBE Filter 1                    | 9  | BBE1a   | BBE1b   | 32 | Bch BBE Filter 1                   |
| Ach BBE Filter 2                    | 10 | BBE2a   | BBE2b   | 31 | Bch BBE Filter 2                   |
| Ach Tone High Frequency             | 11 | TONE-Ha | TONE-Hb | 30 | Bch Tone High Frequency            |
| Ach Tone Low Frequency              | 12 | TONE-La | TONE-Lb | 29 | Bch Tone Low Frequency             |
| Ach Line Output (4.5dB)             | 13 | LINEa   | LINEb   | 28 | Bch Line Output (4.5dB)            |
| Ach Main Output (0dB)               | 14 | OUTa    | OUTb    | 27 | Bch Main Output (0dB)              |
| AGC                                 | 15 | AGC     | CSR     | 26 | DAC Output for Surround ON/OFF     |
| DAC Output for Ach Volume & Balance | 16 | CVa     | CTH     | 25 | DAC Output for Tone High Frequency |
| DAC Output for Bch Volume & Balance | 17 | CVb     | CTL     | 24 | DAC Output for Tone Low Frequency  |
| I <sup>2</sup> C Bus SDA            | 18 | SDA     | CSB     | 23 | DAC Output for BBE ON/OFF          |
| I <sup>2</sup> C Bus SCL            | 19 | SCL     | Vref    | 22 | Reference Voltage                  |
| GND                                 | 20 | GND     | V+      | 21 | Power Supply                       |

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

| PARAMETER                   | SYMBOL         | RATING      | UNIT |
|-----------------------------|----------------|-------------|------|
| Supply Voltage              | V <sup>+</sup> | 14          | 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, Rg=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           | 13.0          | 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=1%                        | 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                                 | -    | -             | -70           | dB             |
| Channel Balance           | G <sub>CB</sub>    | VOL=0dB                                  | -1.5 | 0.0           | 1.5           | dB             |
| Balance Level A-A         | BAL <sub>AA</sub>  | Full panning to Ach, OUTa                | -2.0 | 0.0           | 2.0           | dB             |
| Balance Level A-B         | BAL <sub>AB</sub>  | Full panning to Ach, OUTb                | -    | -             | -70           | dB             |
| Balance Level B-B         | BAL <sub>BB</sub>  | Full panning to Bch, OUTb                | -2.0 | 0.0           | 2.0           | dB             |
| Balance Level B-A         | BAL <sub>BA</sub>  | Full panning to Bch, OUTa                | -    | -             | -70           | dB             |
| Total Harmonic Distortion | THD                | Vo=0.5Vrms<br>BW=400Hz to 30kHz          | -    | 0.02          | 0.1           | %              |
| Input Selector Cross Talk | CT                 | Vin=2Vrms                                | -    | -             | -70           | dB             |
| Channel Separation        | CS                 | Vin=2Vrms                                | -    | -             | -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) | TBD           | dBV<br>(μVrms) |
| Output Noise 3            | V <sub>NO3</sub>   | LINEOUT<br>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<br>VOL=Mute<br>BW=400Hz to 30kHz | -    | -101<br>(8.9) | TBD           | dBV<br>(μVrms) |

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

● TONE CONTROL

| 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 | -12.5 | -15.0 | -17.5 | 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   | -12.5 | -15.0 | -17.5 | dB   |

● SUB-TONE CONTROL

| 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>  | V <sub>in</sub> =50mVrms  | 1.5  | 3.5  | 5.5  | dB   |
| AGC FLAT 1 | AGC <sub>FLT1</sub> | V <sub>in</sub> =300mVrms | -2.5 | 0.0  | 2.5  | dB   |
| AGC FLAT 2 | AGC <sub>FLT2</sub> | V <sub>in</sub> =400mVrms | -2.5 | 0.0  | 2.5  | dB   |
| AGC FLAT 3 | AGC <sub>FLT3</sub> | V <sub>in</sub> =500mVrms | -2.5 | 0.0  | 2.5  | dB   |
| AGC FLAT 4 | AGC <sub>FLT4</sub> | V <sub>in</sub> =600mVrms | -2.5 | 0.0  | 2.5  | dB   |
| AGC CUT    | AGC <sub>CUT</sub>  | V <sub>in</sub> =2Vrms    | -14  | -10  | -6.0 | dB   |

● BBE (BBE-ON)

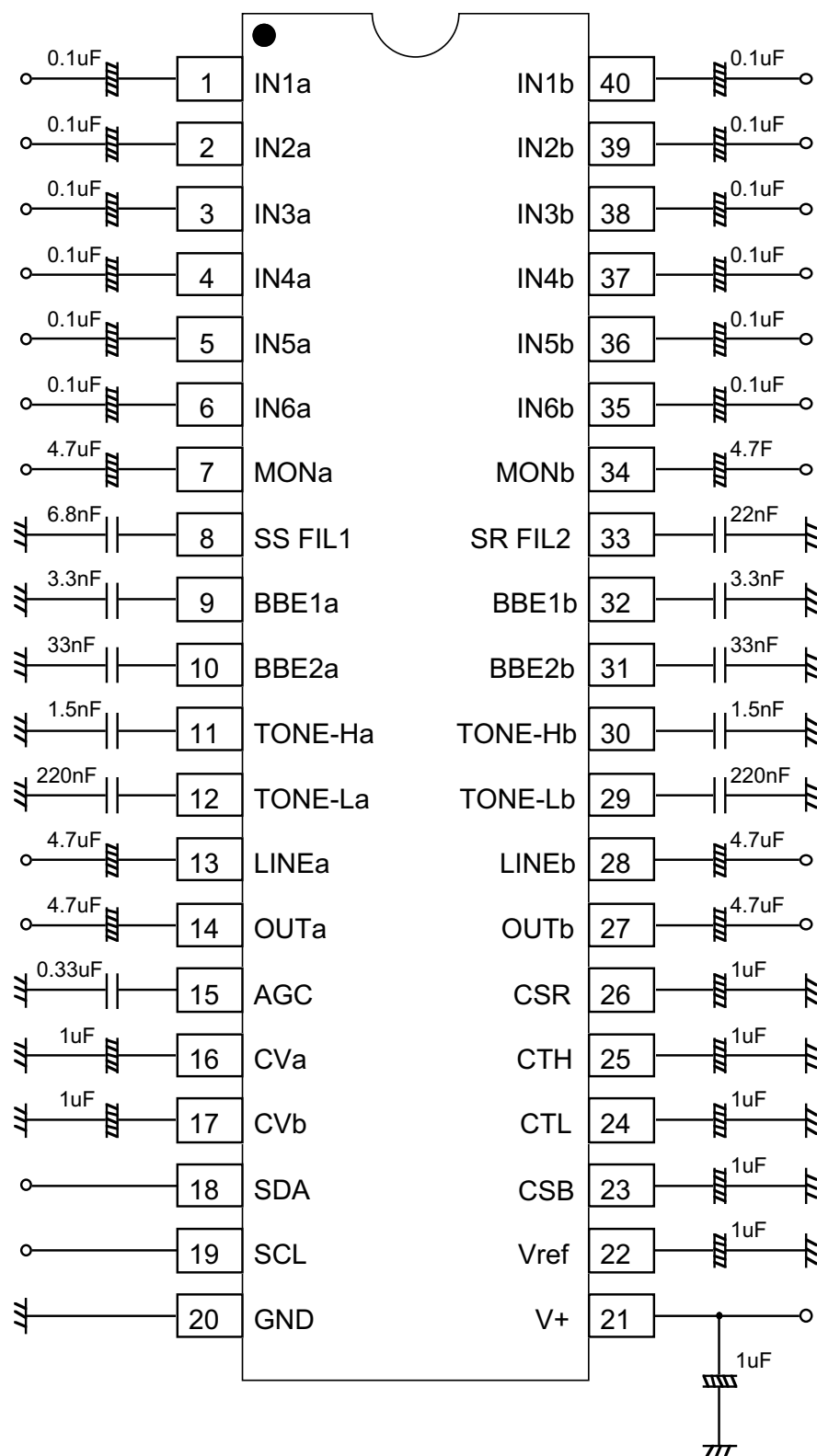
| PARAMETER                      | SYMBOL              | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------------|---------------------|----------------|------|------|------|------|
| BBE Low Frequency Boost Level  | BBE <sub>LOW</sub>  | BBE-Low=+15dB  | -    | 15.0 | -    | dB   |
| BBE High Frequency Boost Level | BBE <sub>HIGH</sub> | BBE-High=+15dB | -    | 15.0 | -    | dB   |

■ ELECTRICAL CHARACTERISTICS (  $T_a=25^{\circ}\text{C}$ ,  $V^+=9\text{V}$ ,  $R_g=600\Omega$ ,  $R_L=47\text{k}\Omega$ ,  $V_{in}=100\text{mVrms}$ )

● SURROUND

| PARAMETER      | SYMBOL      | TEST CONDITION                                        | MIN. | TYP. | MAX. | UNIT |
|----------------|-------------|-------------------------------------------------------|------|------|------|------|
| SURROUND SIM A | $SR_{SIMA}$ | $A_{in}+B_{in} \rightarrow A_{out}$ , $f=1\text{kHz}$ | 1.0  | 3.0  | 5.0  | dB   |
| SURROUND SIM B | $SR_{SIMB}$ | $A_{in}+B_{in} \rightarrow B_{out}$ , $f=1\text{kHz}$ | 1.0  | 3.0  | 5.0  | dB   |
| SURROUND 3D 1  | $SR_{3D1}$  | $A_{in} \rightarrow A_{out}$ , $f=100\text{Hz}$       | 8.0  | 10.0 | 12.0 | dB   |
| SURROUND 3D 2  | $SR_{3D2}$  | $A_{in} \rightarrow A_{out}$ , $f=10\text{kHz}$       | -2.0 | 0.0  | 2.0  | dB   |
| SURROUND 3D 3  | $SR_{3D3}$  | $A_{in} \rightarrow B_{out}$ , $f=100\text{Hz}$       | 4.5  | 6.5  | 8.5  | dB   |

## ■ APPLICATION CIRCUIT

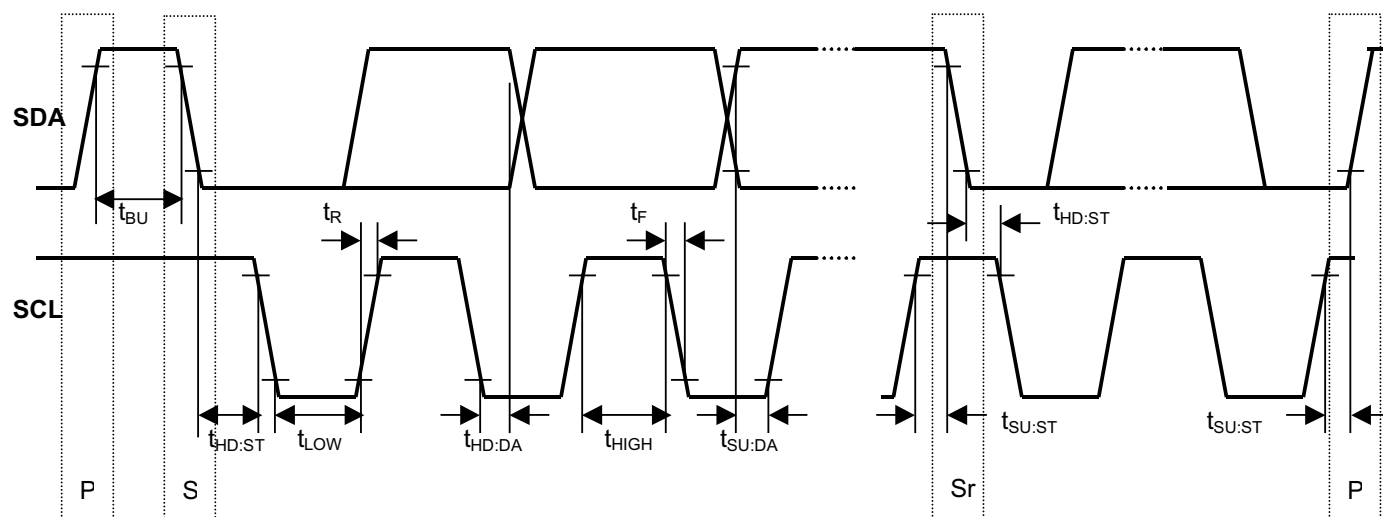


## ■ I<sup>2</sup>C BUS Block CHARACTERISTICS (SDA, SCL)

| 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

### ● CONTROL REGISTER TABLE

| Select Address | BIT     |      |    |    |          |      |          |     |
|----------------|---------|------|----|----|----------|------|----------|-----|
|                | D7      | D6   | D5 | D4 | D3       | D2   | D1       | D0  |
| 00H            | VOL     |      |    |    |          |      |          |     |
| 01H            | CHS     | BAL  |    |    |          |      | SR1      | SR0 |
| 02H            | BCB     | BASS |    |    |          | BCSB | SUB-BASS |     |
| 03H            | BCT     | TREB |    |    |          | BCST | SUB-TREB |     |
| 04H            | BBE-Low |      |    |    | BBE-High |      |          |     |
| 05H            | OUT     | SEL  |    |    | AGC1     | AGC0 | AGC      | BBE |

### ● CONTROL REGISTER DEFAULT VALUE

| 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  |

## ■ I<sup>2</sup>C CONTROL COMMAND DESCRIPTION

### ● MASTER VOLUME CONTROL

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

The attenuator is consisted of both the Volume1 and Volume2. The total attenuation level is summing of each attenuation level of the Volume1 and Volume2. The attenuation for both the Volume1 and Volume2 are always synchronized to have the same attenuation levels for each other, and are not controllable independently for each other.

- "VOL" : Sets the total attenuation level for the both Ach and Bch(up to 84dB, 0.33dB/step)

For the detail, you can refer to the table on the page 12.

### ● CHANNEL BALANCE AND SURROUND MODE CONTROL

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

#### ◆ Channel Balance Control

To control the balance between Ach and Bch, the both commands "CHS" and "BAL" should be set. For example, to move a sound image to Ach-side, Bch should be attenuated with no attenuation on Ach. The command "CHS" defines the channel should be attenuate, and the command "BAL" defines the attenuation level itself. The attenuation for the balance control is consisted of the both Volume1 and Volume2, has the same structure with Master Volume Control described above.

- "CHS" : Defines the channel should be attenuated

| The channel should be attenuated | CHS (D7) |
|----------------------------------|----------|
| Bch                              | 0        |
| Ach                              | 1        |

- "BAL" : Defines the attenuation level for the specified channel with command "CHS"(up to 30dB, 1dB/Step)

For the detail, you can refer to the table on the page 14.

#### ◆ Surround Mode Control

- "SR1", "SR0" : Surround Mode Switch

| Surround Mode           | SR1 (D1) | SR0 (D0) |
|-------------------------|----------|----------|
| Surround OFF (Bypass)   | 0        | 0        |
| Simulated Surround      | 0        | 1        |
| 3D Surround – High Mode | 1        | 0        |
| 3D Surround – Low Mode  | 1        | 1        |

## ●BASS-TONE CONTROL SETTING

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

- "BCB" : Defines the Bass-Tone Control Mode as Boost or Cut

| Bass Tone Control Mode | BCB (D7) |
|------------------------|----------|
| Cut                    | 0        |
| Boost                  | 1        |

- "BASS" : Sets the Cut or Boost level for Bass-Tone Control(up to 15dB, 1dB/Step)  
For the detail, you can refer to the table on the page 15.

- "BCSB" : Defines the Sub-Bass-Tone Control Mode as Boost or Cut

| Sub-Bass Tone Control Mode | BCSB (D2) |
|----------------------------|-----------|
| Cut                        | 0         |
| Boost                      | 1         |

- "SUB-BASS" : Sets the Cut or Boost level for Sub-Bass-Tone Control(up to 3dB, 1dB/Step)  
For the detail, you can refer to the table on the page 15.

## ●TREBLE-TONE CONTROL SETTING

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

- "BCT" : Defines the Treble-Tone Control Mode as Boost or Cut

| Treble-Tone Control Mode | BCT (D7) |
|--------------------------|----------|
| Cut                      | 0        |
| Boost                    | 1        |

- "TREB" : Sets the Cut or Boost level for Treble-Tone Control(up to 15dB, 1dB/Step)  
For the detail, you can refer to the table on the page 15.

- "BCST" : Defines the Sub-Treble-Tone Control Mode as Boost or Cut

| Sub-Treble-Tone Control Mode | BCST (D2) |
|------------------------------|-----------|
| Cut                          | 0         |
| Boost                        | 1         |

- "SUB-TREB" : Sets the Cut or Boost level for Sub-Treble-Tone Control(up to 3dB, 1dB/Step)  
For the detail, you can refer to the table on the page 15.

●BBE BOOST LEVEL SETTING

| Select Address | BIT     |    |    |    |          |    |    |    |
|----------------|---------|----|----|----|----------|----|----|----|
|                | D7      | D6 | D5 | D4 | D3       | D2 | D1 | D0 |
| 04H            | BBE-Low |    |    |    | BBE-High |    |    |    |

The command “BBE-Low” and “BBE-High” can set the only BBE boost level, not BBE ON/OFF control. To activate the BBE, the command “BBE”(Address=05H) must be ON.

- “BBE-Low” : Sets the BBE low frequency boost level(up to 15dB, 1dB/Step)
- “BBE-High” : Sets the BBE high frequency boost level(up to 15dB, 1dB/Step)

For the detail, you can refer to the table on the page 16.

●OUTPUT ON/OFF, INPUT SELECTOR, AGC and BBE ON/OFF CONTROL

| Select Address | BIT |     |    |    |      |      |     |     |
|----------------|-----|-----|----|----|------|------|-----|-----|
|                | D7  | D6  | D5 | D4 | D3   | D2   | D1  | D0  |
| 05H            | OUT | SEL |    |    | AGC1 | AGC0 | AGC | BBE |

◆Output ON/OFF

- “OUT” : Output ON/OFF Switch

| Output           | OUT (D7) |
|------------------|----------|
| Output OFF(Mute) | 0        |
| Output ON        | 1        |

◆Input Selector

- “SEL” : Input Selector Control

For the detail, you can refer to the table on the page 17.

◆AGC Control

- “AGC1”, “AGC0” : Set the AGC Flat Level
- “AGC” : AGC ON/OFF Switch

| AGC Flat Level | AGC1 (D3) | AGC0 (D2) | AGC (D0) |
|----------------|-----------|-----------|----------|
| 300mVrms       | 0         | 0         | 1        |
| 400mVrms       | 0         | 1         | 1        |
| 500mVrms       | 1         | 0         | 1        |
| 600mVrms       | 1         | 1         | 1        |
| AGC OFF        | -         | -         | 0        |

◆BBE ON/OFF Control

- “BBE” : BBE ON/OFF Switch

| BBE ON/OFF | BBE (D0) |
|------------|----------|
| BBE OFF    | 0        |
| BBE ON     | 1        |

## ■ I<sup>2</sup>C CONTROL COMMAND SETTING TABLE

### ● MASTER VOLUME CONTROL (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  |

(MASTER VOLUME CONTROL cont'd)

|           |     | VOL |    |    |    |    |    |    |    |
|-----------|-----|-----|----|----|----|----|----|----|----|
| Gain (dB) | HEX | D7  | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| -41       | 84  | 1   | 0  | 0  | 0  | 0  | 1  | 0  | 0  |
| -42       | 81  | 1   | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
| -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  |

●CHANNEL BALANCE CONTROL(Select Address : 01H)

| Gain(dB) | BAL |    |    |    |    |
|----------|-----|----|----|----|----|
|          | 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  |

●BASS-TONE CONTROL(Select Address : 02H)

/ TREBLE-TONE CONTROL(Select Address : 03H)

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

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

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

|                 |                   | SUB-BASS<br>SUB-TREB |    |
|-----------------|-------------------|----------------------|----|
| Cut<br>Gain(dB) | Boost<br>Gain(dB) | D1                   | D0 |
| 0               | 0                 | 0                    | 0  |
| -1              | 1                 | 0                    | 1  |
| -2              | 2                 | 1                    | 0  |
| -3              | 3                 | 1                    | 1  |

●BBE Low-Frequency Boost Level(Select Address : 04H)

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

●BBE High-Frequency Boost Level(Select Address : 04H)

|                | BBE-High |    |    |    |
|----------------|----------|----|----|----|
| Boost Gain(dB) | D3       | D2 | D1 | D0 |
| 0              | 0        | 0  | 0  | 0  |
| 1              | 0        | 0  | 0  | 1  |
| 2              | 0        | 0  | 1  | 0  |
| 3              | 0        | 0  | 1  | 1  |
| 4              | 0        | 1  | 0  | 0  |
| 5              | 0        | 1  | 0  | 1  |
| 6              | 0        | 1  | 1  | 0  |
| 7              | 0        | 1  | 1  | 1  |
| 8              | 1        | 0  | 0  | 0  |
| 9              | 1        | 0  | 0  | 1  |
| 10             | 1        | 0  | 1  | 0  |
| 11             | 1        | 0  | 1  | 1  |
| 12             | 1        | 1  | 0  | 0  |
| 13             | 1        | 1  | 0  | 1  |
| 14             | 1        | 1  | 1  | 0  |
| 15             | 1        | 1  | 1  | 1  |

## ●Input Selector Control(Select Address : 05H)

| Input Channel<br>Selected | SEL |    |    |
|---------------------------|-----|----|----|
|                           | D6  | D5 | D4 |
| 1                         | 0   | 0  | 0  |
| 2                         | 0   | 0  | 1  |
| 3                         | 0   | 1  | 0  |
| 4                         | 0   | 1  | 1  |
| 5                         | 1   | 0  | 0  |
| 6                         | 1   | 0  | 1  |

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