

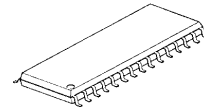
## 6-CHANNEL ELECTRONIC VOLUME

### ■ GENERAL DESCRIPTION

The **NJW1151** is a 6-CHANNEL ELECTRONIC VOLUME, which also includes tone control, balance and trim level control. The **NJW1151** is suitable for multi-channel audio system, such as AV amplifier, mini stereo component, speaker system, and others.

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

### ■ PACKAGE OUTLINE

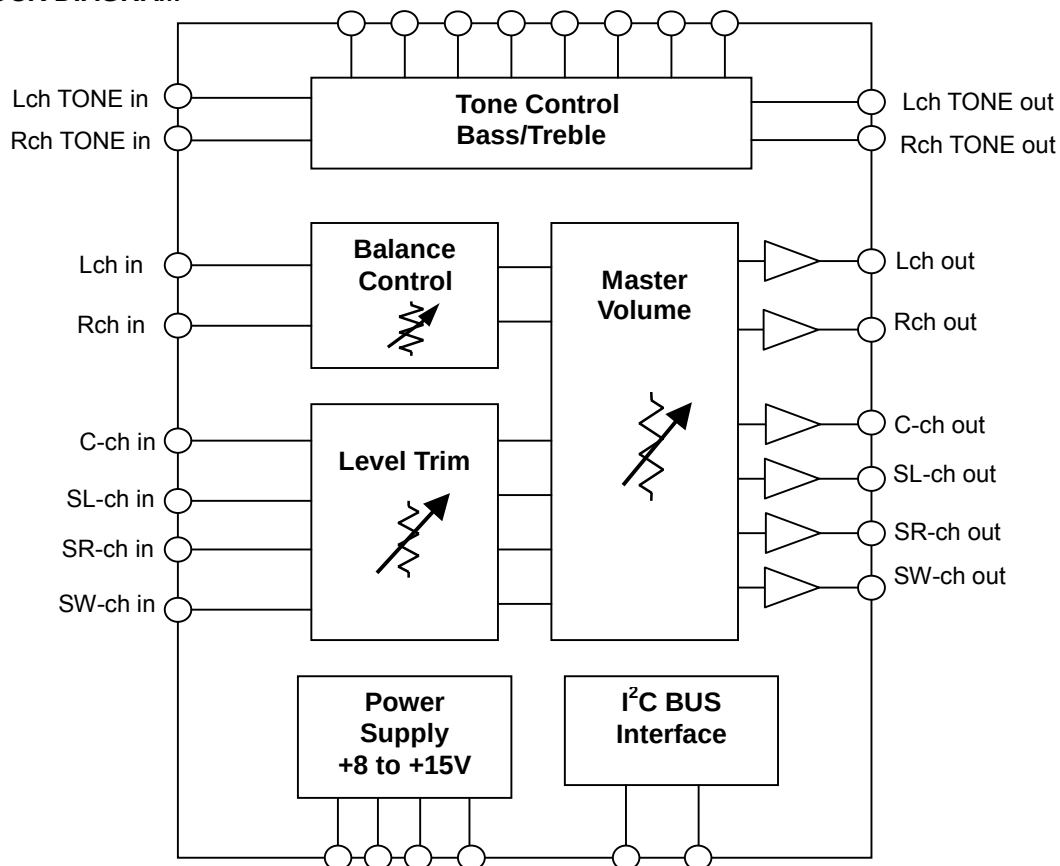


**NJW1151M**

### ■ FEATURES

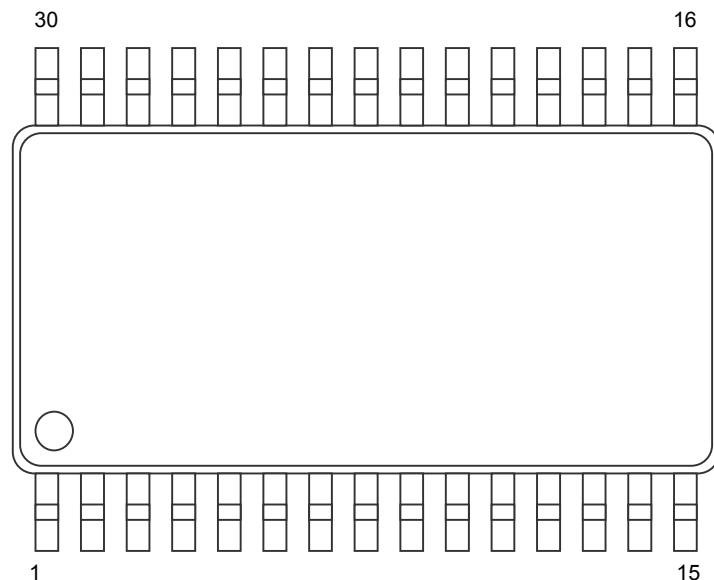
- Operating Voltage +8.0 to +15.0V
- I<sup>2</sup>C BUS Interface
- 6-Channel Master Volume 0 to -79dB, MUTE
- Balance control for L, R-ch 0 to -30dB, MUTE
- Trim Level Control for C, SL, SR, SW-ch 0 to -20dB
- Independent Tone Control (Bass, Treble) for L, R-ch
- Bi-CMOS Technology
- Package Outline SDMP30

### ■ BLOCK DIAGRAM



# NJW1151

## ■ PIN FUNCTION



| No. | SYMBOL | FUNCTION                                           | No. | SYMBOL | FUNCTION                                          |
|-----|--------|----------------------------------------------------|-----|--------|---------------------------------------------------|
| 1   | VREF   | Reference voltage                                  | 16  | SCL    | I <sup>2</sup> C bus clock input                  |
| 2   | V+     | Power supply voltage                               | 17  | SDA    | I <sup>2</sup> C bus data input                   |
| 3   | VREFC  | Reference voltage stabilization capacitor          | 18  | SWOUT  | Volume Sub Woofer channel output                  |
| 4   | RTIN   | Tone control Right channel input                   | 19  | SROUT  | Volume Surround Right channel output              |
| 5   | RTOUT  | Tone control Right channel output                  | 20  | SLOUT  | Volume Surround Left channel volume output        |
| 6   | RTC    | Tone control Right channel Treble filter capacitor | 21  | COUT   | Volume Center channel output                      |
| 7   | RBC1   | Tone control Right channel Bass filter capacitor   | 22  | ROUT   | Volume Right channel output                       |
| 8   | RBC2   | Tone control Right channel Bass filter capacitor   | 23  | LOUT   | Volume Left channel output                        |
| 9   | RBC3   | Tone control Right channel Bass DC cut capacitor   | 24  | LBC3   | Tone control Left channel Bass DC cut capacitor   |
| 10  | LIN    | Volume Left channel input                          | 25  | LBC2   | Tone control Left channel Bass filter capacitor   |
| 11  | RIN    | Volume Right channel input                         | 26  | LBC1   | Tone control Left channel Bass filter capacitor   |
| 12  | CIN    | Volume Center channel input                        | 27  | LTC    | Tone control Left channel Treble filter capacitor |
| 13  | SLIN   | Volume Surround Left channel input                 | 28  | LTOUT  | Tone control Left channel output                  |
| 14  | SRIN   | Volume Surround Right channel input                | 29  | LTIN   | Tone control Left channel input                   |
| 15  | SWIN   | Volume Sub Woofer channel input                    | 30  | GND    | Ground (IC substrate)                             |

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

| PARAMETER                   | SYMBOL    | RATING      | UNIT |
|-----------------------------|-----------|-------------|------|
| Supply Voltage              | $V^+$     | +15         | V    |
| Maximum Input Voltage       | $V_{IM}$  | $V^{+(*)}$  | V    |
| Power Dissipation           | $P_D$     | 700         | mW   |
| Operating Temperature Range | $T_{opr}$ | -40 to +85  | °C   |
| Storage Temperature Range   | $T_{stg}$ | -40 to +125 | °C   |

(\*) For the maximum input voltage less than 0 to  $V^+$

## ■ ELECTRICAL CHARACTERISTICS (Ta=25°C, $V^+=14V$ , $V_{DD}=5V$ )

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------|--------|----------------|------|------|------|------|
|-----------|--------|----------------|------|------|------|------|

### ◆ Power Supply

|                   |          |           |     |      |      |    |
|-------------------|----------|-----------|-----|------|------|----|
| Operating Voltage | $V^+$    |           | 8.0 | 14.0 | 15.0 | V  |
| Supply Current    | $I_{CC}$ | No Signal | -   | 10   | 30   | mA |

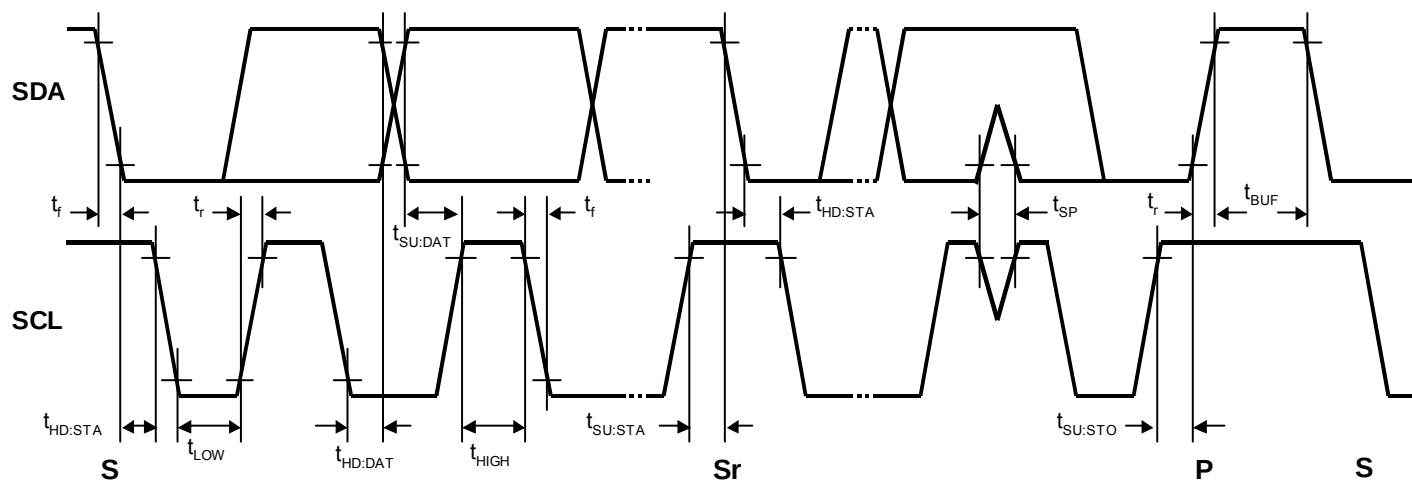
### ◆ Input/Output Characteristics

|                           |                 |                                                                        |      |                      |                     |               |
|---------------------------|-----------------|------------------------------------------------------------------------|------|----------------------|---------------------|---------------|
| Voltage Gain              | $G_V$           | $V_{IN}=1V_{rms}$ , $f=1kHz$<br>Master=0dB, Balance=0dB<br>Trimmer=0dB | -0.5 | 0                    | 0.5                 | dB            |
| Voltage Gain Error        | $\Delta G_V$    | $V_{IN}=1V_{rms}$ , $f=1kHz$<br>Master=0dB                             | -0.5 | 0                    | 0.5                 | dB            |
| Maximum Attenuation 1     | $A_{TT1}$       | $f=1kHz$ , $V_{IN}=1V_{rms}$<br>Master=-79dB                           | -    | -79                  | -                   | dB            |
| Maximum Attenuation 2     | $A_{TT2}$       | $f=1kHz$ , $V_{IN}=1V_{rms}$<br>Mute                                   | -    | -90                  | -                   | dB            |
| Attenuation Error         | $\Delta A_{TT}$ | $f=1kHz$ , $V_{IN}=1V_{rms}$<br>Master=-50dB<br>Trimmer=-10dB          | -1   | 0                    | 1                   | dB            |
| Maximum Output Voltage    | $V_{OM}$        | $f=1kHz$ , THD=1%<br>Master=0dB                                        | 3.0  | 4.0                  | -                   | Vrms          |
| Output Noise              | $V_{NO}$        | Master=0dB,<br>$R_g=0$ , A-weight                                      | -    | -110<br>(3.2 $\mu$ ) | -100<br>(10 $\mu$ ) | dBV<br>(Vrms) |
| Total Harmonic Distortion | T.H.D.          | $f=1kHz$ , $V_o=1V_{rms}$ ,<br>Master=0dB, Trimmer=0dB                 | -    | 0.005                | 0.05                | %             |
| Channel Separation        | CS              | $f=1kHz$ , $V_o=1V_{rms}$<br>Master=0dB, A-weight                      | -    | -90                  | -80                 | dB            |

### ◆ Tone Control Characteristics

|                    |            |                                          |     |     |    |    |
|--------------------|------------|------------------------------------------|-----|-----|----|----|
| Treble Boost Gain1 | $HF_{BST}$ | $V_o=1V_{rms}$ $f=10kHz$<br>Treble=10dB  | 8   | 10  | 12 | dB |
| Treble Boost Gain2 | $HF_{CUT}$ | $V_o=1V_{rms}$ $f=10kHz$<br>Treble=-10dB | -12 | -10 | -8 | dB |
| Bass Boost Gain1   | $LF_{BST}$ | $V_o=1V_{rms}$ $f=50Hz$<br>Bass=10dB     | 8   | 10  | 12 | dB |
| Bass Boost Gain2   | $LF_{CUT}$ | $V_o=1V_{rms}$ $f=50Hz$<br>Bass=-10dB    | -12 | -10 | -8 | dB |

## ■TIMING ON THE I<sup>2</sup>C BUS (SDA,SCL)



## ■CHARACTERISTICS OF I/O STAGES FOR I<sup>2</sup>C BUS (SDA,SCL)

I<sup>2</sup>C BUS Load Conditions

STANDARD MODE: Pull up resistance 4k $\Omega$  (Connected to +5V), Load capacitance 200pF (Connected to GND)

| PARAMETER                                                                                             | SYMBOL   | Standard mode |      |      | UNIT    |
|-------------------------------------------------------------------------------------------------------|----------|---------------|------|------|---------|
|                                                                                                       |          | MIN.          | TYP. | MAX. |         |
| Low Level Input Voltage                                                                               | $V_{IL}$ | 0.0           | -    | 1.5  | V       |
| High Level Input Voltage                                                                              | $V_{IH}$ | 3.0           | -    | 5.0  | V       |
| Low level output voltage (3mA at SDA pin)                                                             | $V_{OL}$ | 0             | -    | 0.4  | V       |
| Input current each I/O pin with an input voltage between 0.1V <sub>DD</sub> and 0.9V <sub>DDmax</sub> | $I_i$    | -10           | -    | 10   | $\mu$ A |

## ■ CHARACTERISTICS OF BUS LINES (SDA,SCL) FOR I<sup>2</sup>C-BUS DEVICES

| PARAMETER                                        | SYMBOL       | Standard mode |      |      | UNIT    |
|--------------------------------------------------|--------------|---------------|------|------|---------|
|                                                  |              | MIN.          | TYP. | MAX. |         |
| SCL clock frequency                              | $f_{SCL}$    | -             | -    | 100  | kHz     |
| Hold time (repeated) START condition.            | $t_{HD:STA}$ | 4.0           | -    | -    | $\mu s$ |
| Low period of the SCL clock                      | $t_{LOW}$    | 4.7           | -    | -    | $\mu s$ |
| High period of the SCL clock                     | $t_{HIGH}$   | 4.0           | -    | -    | $\mu s$ |
| Set-up time for a repeated START condition       | $t_{SU:STA}$ | 4.7           | -    | -    | $\mu s$ |
| Data hold time <sup>NOTE)</sup>                  | $t_{HD:DAT}$ | 0             | -    | -    | $\mu s$ |
| Data set-up time                                 | $t_{SU:DAT}$ | 250           | -    | -    | ns      |
| Rise time of both SDA and SCL signals            | $t_r$        | -             | -    | 1000 | ns      |
| Fall time of both SDA and SCL signals            | $t_f$        | -             | -    | 300  | ns      |
| Set-up time for STOP condition                   | $t_{SU:STO}$ | 4.0           | -    | -    | $\mu s$ |
| Bus free time between a STOP and START condition | $t_{BUF}$    | 4.7           | -    | -    | $\mu s$ |
| Capacitive load for each bus line                | $C_b$        | -             | -    | 400  | pF      |
| Noise margin at the Low level                    | $V_{nL}$     | 0.5           | -    | -    | V       |
| Noise margin at the High level                   | $V_{nH}$     | 1             | -    | -    | V       |

$C_b$  ; total capacitance of one bus line in pF.

NOTE). Data hold time :  $t_{HD:DAT}$

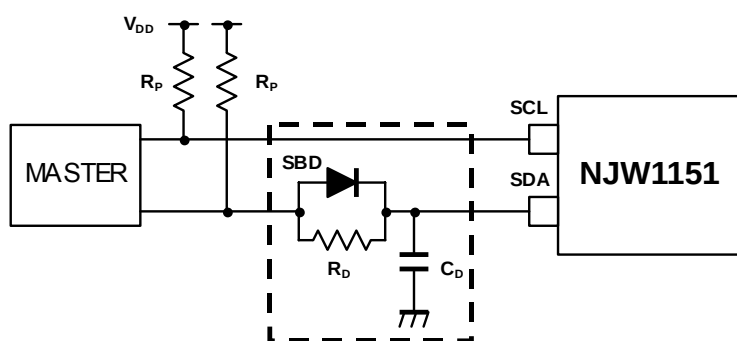
Please hold the Data Hold Time ( $t_{HD:DAT}$ ) to 300ns or more to avoid status of unstable at SCL falling edge.

The SDA block in the NJW1151 does not hold data. Add external data-delay-circuit of the SDA terminal, in case of not providing a hold time of at least 300nsec for the SDA in the master device.

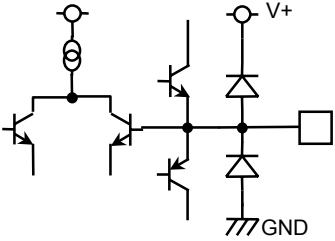
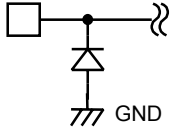
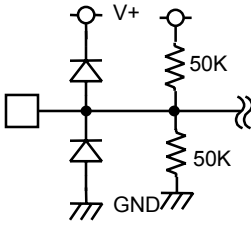
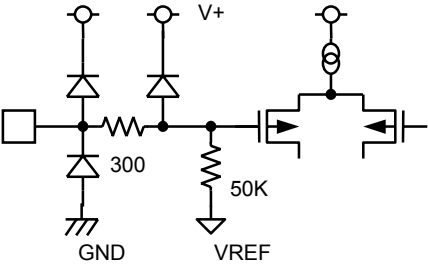
The time-consists of the data-delay-circuit of the SDA terminal are as follows.

- (a) Low level  $\rightarrow$  High level:  $T_{LH} \approx R_P \cdot C_D$
- (b) High level  $\rightarrow$  Low level:  $T_{HL} \approx R_D \cdot C_D$

In addition, Schottky barrier diode (SBD) influences a Low level at the Acknowledge. Therefore choose the low forward voltage ( $V_f$ ) as much as possible.



## ■ TERMINAL DESCRIPTION

| No.     | SYMBOL       | FUNCTION                                                  | EQUIVALENT CIRCUIT                                                                   | TERMINAL VOLTAGE |
|---------|--------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------|------------------|
| 1       | VREF         | Reference voltage                                         |    | $V+ / 2$         |
| 2       | V+           | Power supply voltage                                      |   | $V^+$            |
| 3       | VREFC        | Reference voltage stabilization capacitor                 |  | $V+ / 2$         |
| 4<br>29 | RTIN<br>LTIN | Tone control<br>Right channel input<br>Left channel input |  | $V+ / 2$         |

## ■TERMINAL DESCRIPTION

| No.     | SYMBOL         | FUNCTION                                                                                            | EQUIVALENT CIRCUIT | TERMINAL VOLTAGE |
|---------|----------------|-----------------------------------------------------------------------------------------------------|--------------------|------------------|
| 5<br>28 | RTOUT<br>LTOUT | Tone control<br>Right channel output<br>Left channel output                                         |                    | $V+ / 2$         |
| 6<br>27 | RTC<br>LTC     | Tone control<br>Right channel<br>Treble filter capacitor<br>Left channel<br>Treble filter capacitor |                    | $V+ / 2$         |
| 7<br>26 | RBC1<br>LBC1   | Tone control<br>Right channel<br>Bass filter capacitor<br>Left channel<br>Bass filter capacitor     |                    | $V+ / 2$         |
| 8<br>25 | RBC2<br>LBC2   | Tone control<br>Right channel<br>Bass filter capacitor<br>Left channel<br>Bass filter capacitor     |                    | $V+ / 2$         |

## ■ TERMINAL DESCRIPTION

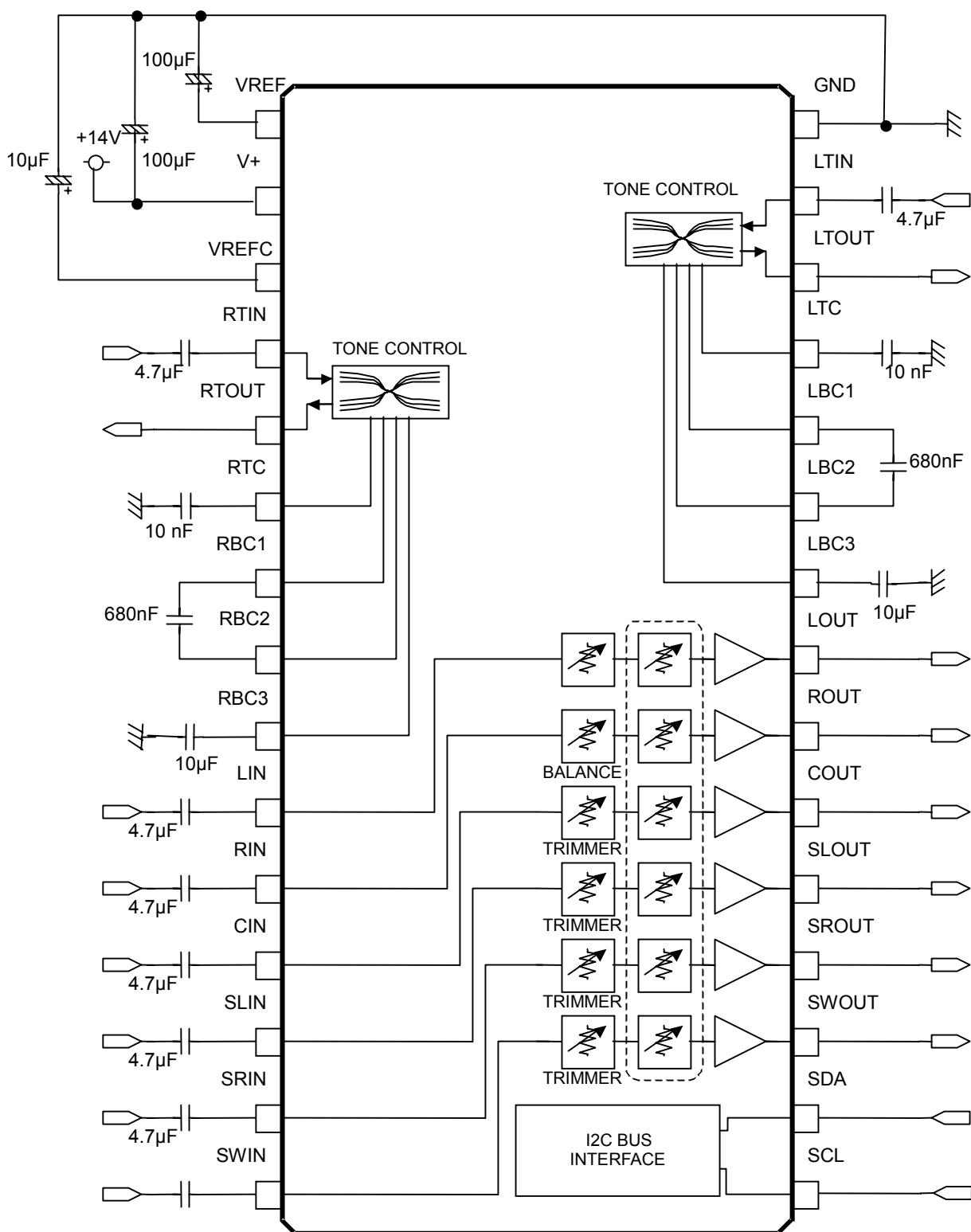
| No.                              | SYMBOL                                    | FUNCTION                                                                                                                                                               | EQUIVALENT CIRCUIT                        | TERMINAL VOLTAGE |
|----------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|------------------|
| 9<br>24                          | RBC3<br>LBC3                              | Tone control<br>Right channel<br>Bass DC cut capacitor<br>Left channel<br>Bass DC cut capacitor                                                                        |                                           | $V+ / 2$         |
| 10<br>11<br>12<br>13<br>14<br>15 | LIN<br>RIN<br>CIN<br>SLIN<br>SRIN<br>SWIN | Volume<br>Left channel input<br>Right channel input<br>Center channel input<br>Surround Left channel input<br>Surround Right channel input<br>Sub Woofer channel input |                                           | $V+ / 2$         |
| 16                               | SCL                                       | I <sup>2</sup> C bus clock input                                                                                                                                       | <p>( Rp ; External pull up resistor )</p> | -                |
| 17                               | SDA                                       | I <sup>2</sup> C bus data input                                                                                                                                        | <p>( Rp ; External pull up resistor )</p> | -                |



## ■TERMINAL DESCRIPTION

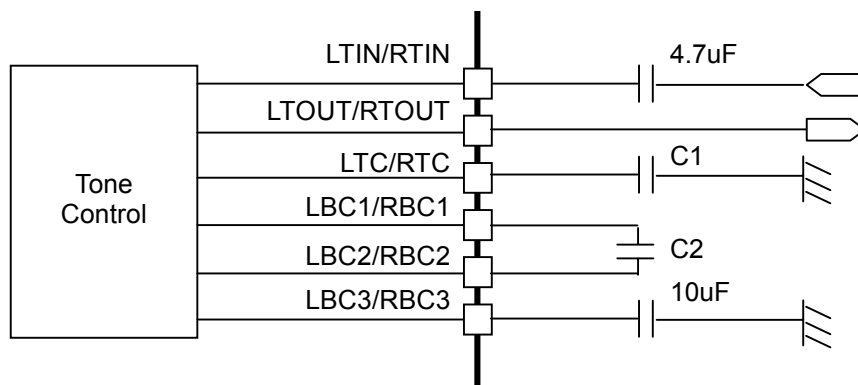
| No.                              | SYMBOL                                          | FUNCTION                                                                                                                                                                     | EQUIVALENT CIRCUIT | TERMINAL VOLTAGE |
|----------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------|
| 18<br>19<br>20<br>21<br>22<br>23 | SWOUT<br>SROUT<br>SLOUT<br>COUT<br>ROUT<br>LOUT | Volume<br>Left channel output<br>Right channel output<br>Center channel output<br>Surround Left channel output<br>Surround Right channel output<br>Sub Woofer channel output |                    | $V+ / 2$         |

## APPLICATION CIRCUIT



## ■ Definition of cut-off frequency for Tone Control

Cut-off frequency for Tone Control is adjustable with changing the capacitor C1, C2 in below circuit.  
See the next function for the cut-off frequency.



EX) C1 = 10nF, C2 = 680nF  
Cut-off frequency for Treble = 3.9kHz  
Cut-off frequency for Bass = 238Hz

1) TREBLE = +/-10dB

2) BASS = +/-10dB

$$f_c = \frac{39.2 * 10^{-6}}{C1} (kHz)$$

$$f_c = \frac{161.7 * 10^{-6}}{C2} (Hz)$$

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

### ● I<sup>2</sup>C BUS FORMAT

S: Starting Term      A: Acknowledge Bit      P: Ending Term

| MSB  | LSB           | MSB  | LSB            | MSB  | LSB  |      |      |
|------|---------------|------|----------------|------|------|------|------|
| S    | Slave Address | A    | Select Address | A    | Data | A    | P    |
| 1bit | 8bit          | 1bit | 8bit           | 1bit | 8bit | 1bit | 1bit |

### ● SLAVE ADDRESS

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

R/W=0: Receive Only

R/W=1: No Output Data

### ● CONTROL REGISTER TABLE

| Select Address | BIT           |               |      |                        |             |    |    |    |
|----------------|---------------|---------------|------|------------------------|-------------|----|----|----|
|                | D7            | D6            | D5   | D4                     | D3          | D2 | D1 | D0 |
| 00H            | *             | Master Volume |      |                        |             |    |    |    |
| 01H            | *             |               |      | Left channel Balance   |             |    |    |    |
| 02H            | *             |               |      | Right channel Balance  |             |    |    |    |
| 03H            | *             |               |      | Center Channel Trimmer |             |    |    |    |
| 04H            | *             |               |      | SL Channel Trimmer     |             |    |    |    |
| 05H            | *             |               |      | SR Channel Trimmer     |             |    |    |    |
| 06H            | *             |               |      | SW Channel Trimmer     |             |    |    |    |
| 07H            | Tone (Treble) |               |      |                        | Tone (Bass) |    |    |    |
| 08H            | *             |               | MUTE |                        |             |    |    |    |

\* : Don't care.

On Power up, the master volume mute is activated.

### ● CONTROL REGISTER DEFAULT VALUE

| Select Address | BIT |    |    |    |    |    |    |    |
|----------------|-----|----|----|----|----|----|----|----|
|                | D7  | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 00H            | 0   | 1  | 0  | 1  | 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  | 1  | 0  | 1  | 0  |
| 04H            | 0   | 0  | 0  | 0  | 1  | 0  | 1  | 0  |
| 05H            | 0   | 0  | 0  | 0  | 1  | 0  | 1  | 0  |
| 06H            | 0   | 0  | 0  | 0  | 1  | 0  | 1  | 0  |
| 07H            | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| 08H            | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  |

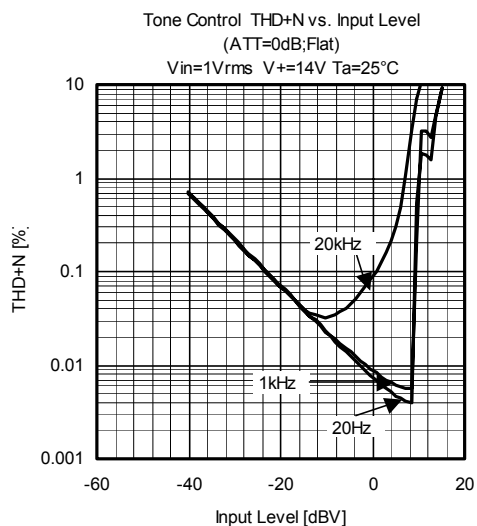
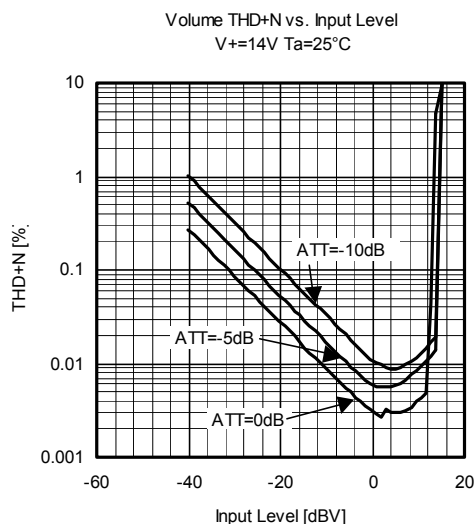
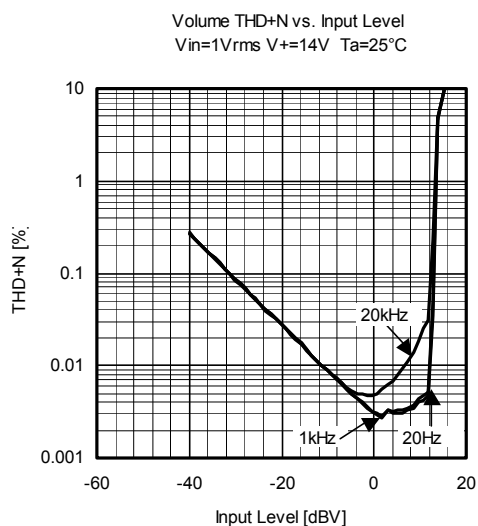
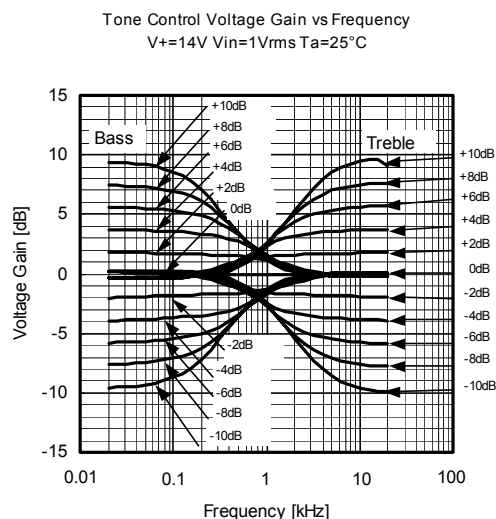
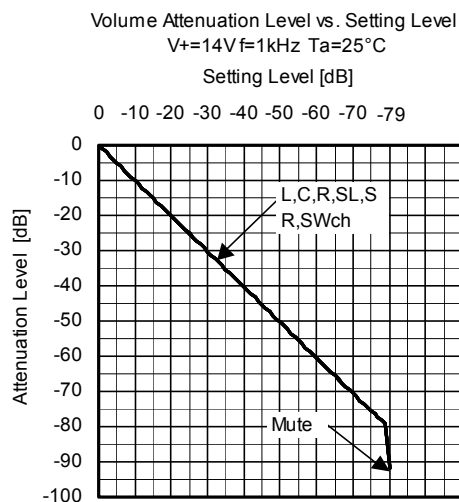
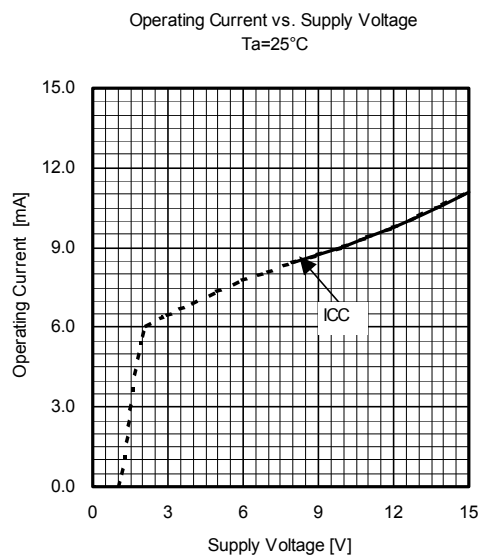
## ● CONTROL COMMAND TABLE

| Select Address | BIT |         |    |    |    |    |    |    | REMARKS                                                                                                                                                                                                                                                                                               |
|----------------|-----|---------|----|----|----|----|----|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | D7  | D6      | D5 | D4 | D3 | D2 | D1 | D0 |                                                                                                                                                                                                                                                                                                       |
| 00H            | *   | VOL     |    |    |    |    |    |    | VOL : Volume control for all channel (1dB/step)<br>Ex.)<br>"0000000"= 0dB<br>"0000001"=-1dB<br>"0000010"=- 2dB<br>:<br>:<br>"1001111"=-79dB<br>"1010000"=MUTE:Default Value<br>Maximum Attenuation : Master Volume : -79dB<br>Trimmer -20dB<br>Minimum Attenuation : Master Volume 0dB<br>Trimmer 0dB |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 1  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 1  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     |         |    |    | :  |    |    |    |                                                                                                                                                                                                                                                                                                       |
|                |     |         |    |    | :  |    |    |    |                                                                                                                                                                                                                                                                                                       |
| 01H            | *   | L-BAL   |    |    |    |    |    |    | L-BAL : Balance control for Left channel (1dB/step)<br>Ex.)<br>"00000"=0dB<br>"00001"=-1dB<br>:<br>:<br>"11110"=-30dB<br>"11111"=MUTE                                                                                                                                                                 |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 1  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 1  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     |         |    |    | :  |    |    |    |                                                                                                                                                                                                                                                                                                       |
|                |     | 1       | 1  | 1  | 1  | 1  | 1  | 1  |                                                                                                                                                                                                                                                                                                       |
| 02H            | *   | R-BAL   |    |    |    |    |    |    | R-BAL : Balance control for Right channel (1dB/step)<br>Ex.)<br>"00000"=0dB<br>"00001"=-1dB<br>:<br>:<br>"11110"=-30dB<br>"11111"= MUTE                                                                                                                                                               |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 1  | 1  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 1  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     |         |    |    | :  |    |    |    |                                                                                                                                                                                                                                                                                                       |
|                |     | 1       | 1  | 1  | 1  | 1  | 1  | 1  |                                                                                                                                                                                                                                                                                                       |
| 03H            | *   | C TRIM  |    |    |    |    |    |    | C TRIM :Center Channel Trimmer Control<br>Ex.)<br>"00000"=0dB<br>"00001"=-1dB<br>"00010"=-2dB<br>:<br>"10100"=-20dB "00001010"=-10dB Default Value                                                                                                                                                    |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 1  | 1  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 1  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     |         |    |    | :  |    |    |    |                                                                                                                                                                                                                                                                                                       |
|                |     | 1       | 0  | 1  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
| 04H            | *   | SL TRIM |    |    |    |    |    |    | SL TRIM :SL Channel Trimmer Control<br>Ex.)<br>"00000"=0dB<br>"00001"=-1dB<br>"00010"=-2dB<br>:<br>"10100"=-20dB "00001010"=-10dB Default Value                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 1  | 1  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 1  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     |         |    |    | :  |    |    |    |                                                                                                                                                                                                                                                                                                       |
|                |     | 1       | 0  | 1  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
| 05H            | *   | SR TRIM |    |    |    |    |    |    | SR TRIM :SR Channel Trimmer Control<br>Ex.)<br>"00000"=0dB<br>"00001"=-1dB<br>"00010"=-2dB<br>:<br>"10100"=-20dB "00001010"=-10dB Default Value                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 1  | 1  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 1  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     |         |    |    | :  |    |    |    |                                                                                                                                                                                                                                                                                                       |
|                |     | 1       | 0  | 1  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
| 06H            | *   | SW TRIM |    |    |    |    |    |    | SW TRIM :SW Channel Trimmer Control<br>Ex.)<br>"00000"=0dB<br>"00001"=-1dB<br>"00010"=-2dB<br>:<br>"10100"=-20dB "00001010"=-10dB Default Value                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 0  | 1  | 1  |                                                                                                                                                                                                                                                                                                       |
|                |     | 0       | 0  | 0  | 0  | 1  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |
|                |     |         |    |    | :  |    |    |    |                                                                                                                                                                                                                                                                                                       |
|                |     | 1       | 0  | 1  | 0  | 0  | 0  | 0  |                                                                                                                                                                                                                                                                                                       |

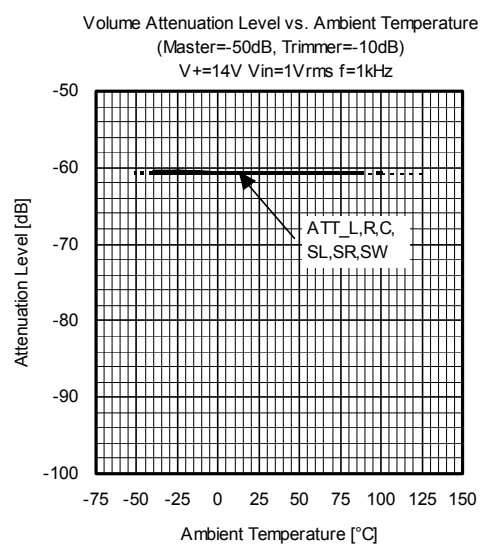
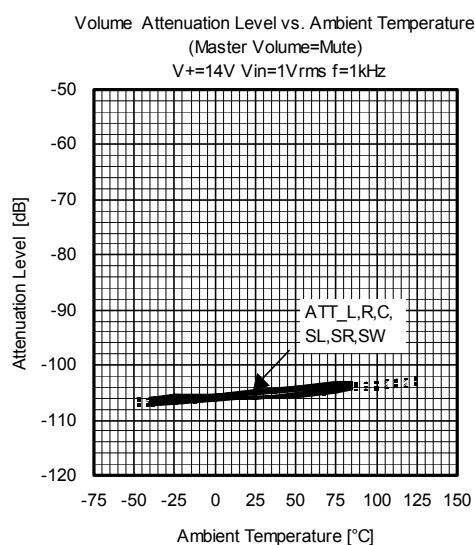
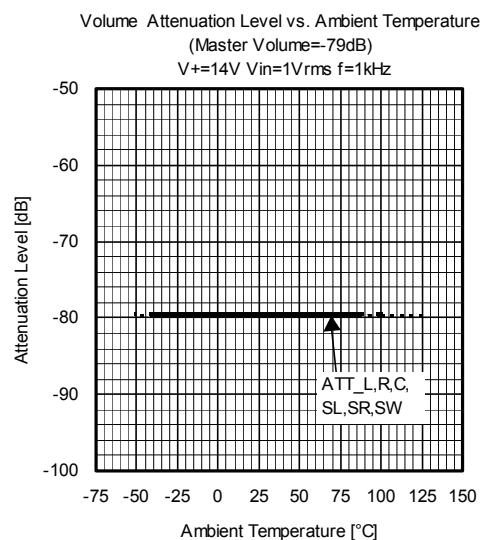
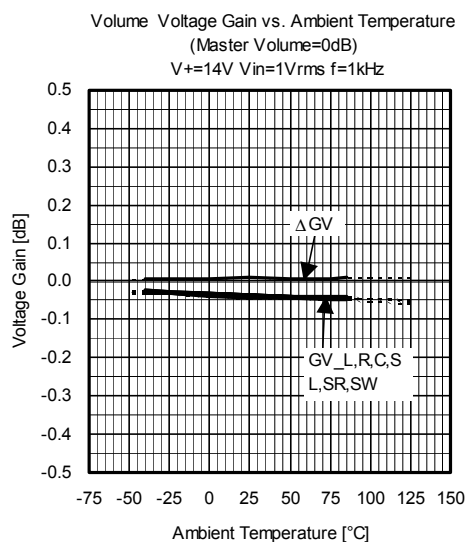
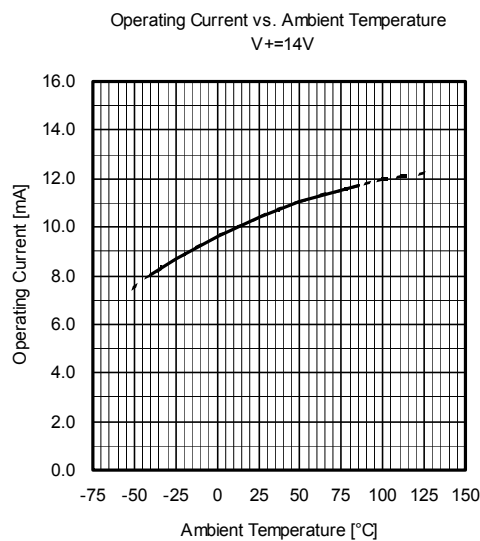
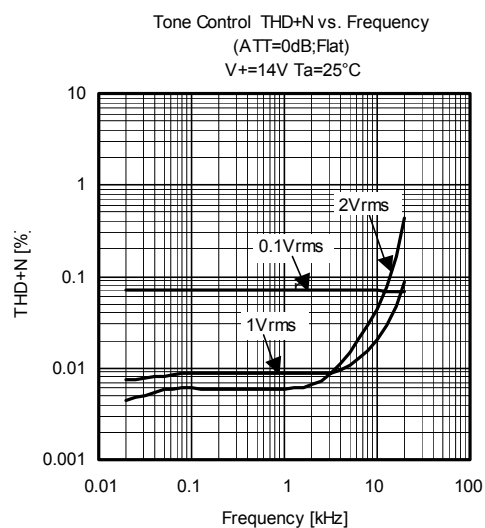
## ● CONTROL COMMAND TABLE

| Select<br>Address | BIT    |    |      |    |      |    |    |    | REMARKS                                                                                                                                            |
|-------------------|--------|----|------|----|------|----|----|----|----------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | D7     | D6 | D5   | D4 | D3   | D2 | D1 | D0 |                                                                                                                                                    |
| 07H               | TREBLE |    |      |    | BASS |    |    |    | TONE CONTROL<br>Ex.) "11011101"=+10dB<br>"11001100"=+8dB<br>:<br>"10001000"=0dB<br>"00000000"=0dB<br>:<br>"01000111"=-8dB<br>:<br>"01010101"=-10dB |
|                   | 1      | 1  | 0    | 1  | 1    | 1  | 0  | 1  |                                                                                                                                                    |
|                   | 1      | 1  | 0    | 0  | 1    | 1  | 0  | 0  |                                                                                                                                                    |
|                   |        |    |      |    | :    |    |    |    |                                                                                                                                                    |
|                   | 1      | 0  | 0    | 0  | 1    | 0  | 0  | 0  |                                                                                                                                                    |
|                   | 0      | 0  | 0    | 0  | 0    | 0  | 0  | 0  |                                                                                                                                                    |
|                   |        |    |      |    | :    |    |    |    |                                                                                                                                                    |
| 0                 | 1      | 0  | 0    | 0  | 1    | 0  | 0  |    |                                                                                                                                                    |
| 0                 | 1      | 0  | 1    | 0  | 1    | 0  | 1  |    |                                                                                                                                                    |
| 08H               | *      |    | MUTE |    |      |    |    |    | MUTE CONTROL<br>Ex.) "0"=OFF<br>"1"=MUTE<br>D5=L ch,D4=R ch,D3=C ch,D2=SL ch,D1=SR ch,D0=SW ch                                                     |
|                   |        |    | 0    |    |      |    |    |    |                                                                                                                                                    |
|                   |        |    | 1    |    |      |    |    |    |                                                                                                                                                    |

## ■ TYPICAL CHARACTERISTICS

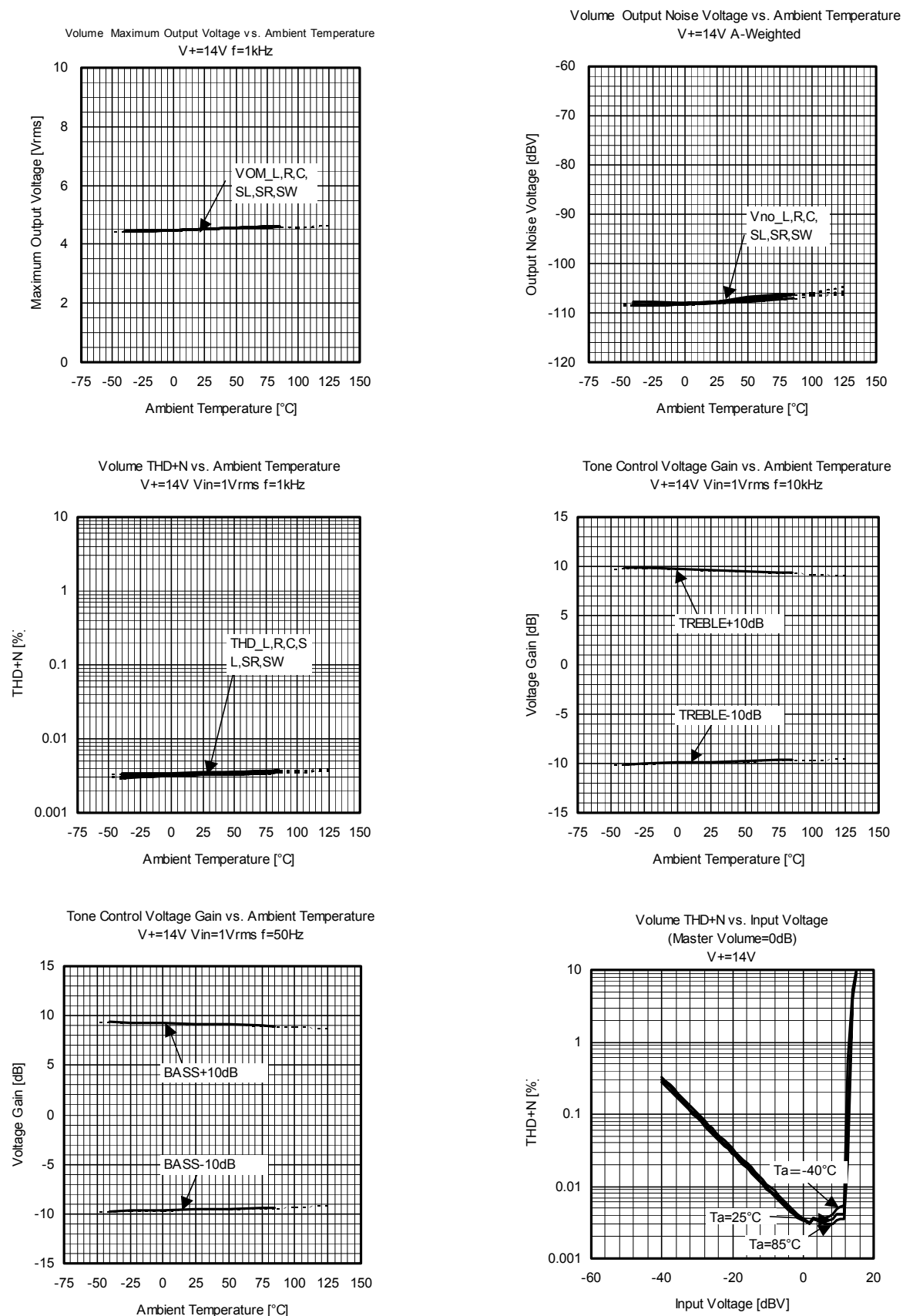


## ■ TYPICAL CHARACTERISTICS

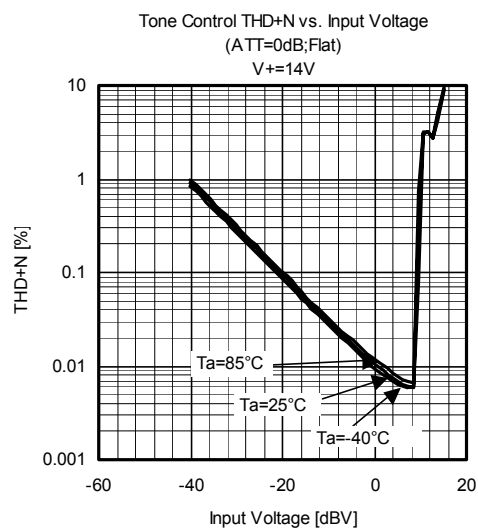




## ■ TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS



### [CAUTION]

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