

## 2-CHANNEL ELECTRONIC VOLUME WITH INPUT SELECTOR AND TONE CONTROL

### ■ GENERAL DESCRIPTION

The NJW1194 is a 2-channel electronic volume with 4-in 1-out stereo audio selector and Tone Control. The NJW1194 performs low noise and low distortion characteristics with resistance ladder circuit.

All of functions are controlled via three-wired serial bus. Selectable 4-Chip address is available for using four chips on same serial bus line.

It's suitable for two-channel stereo system and or multi-channel audio system.

### ■ PACKAGE OUTLINE

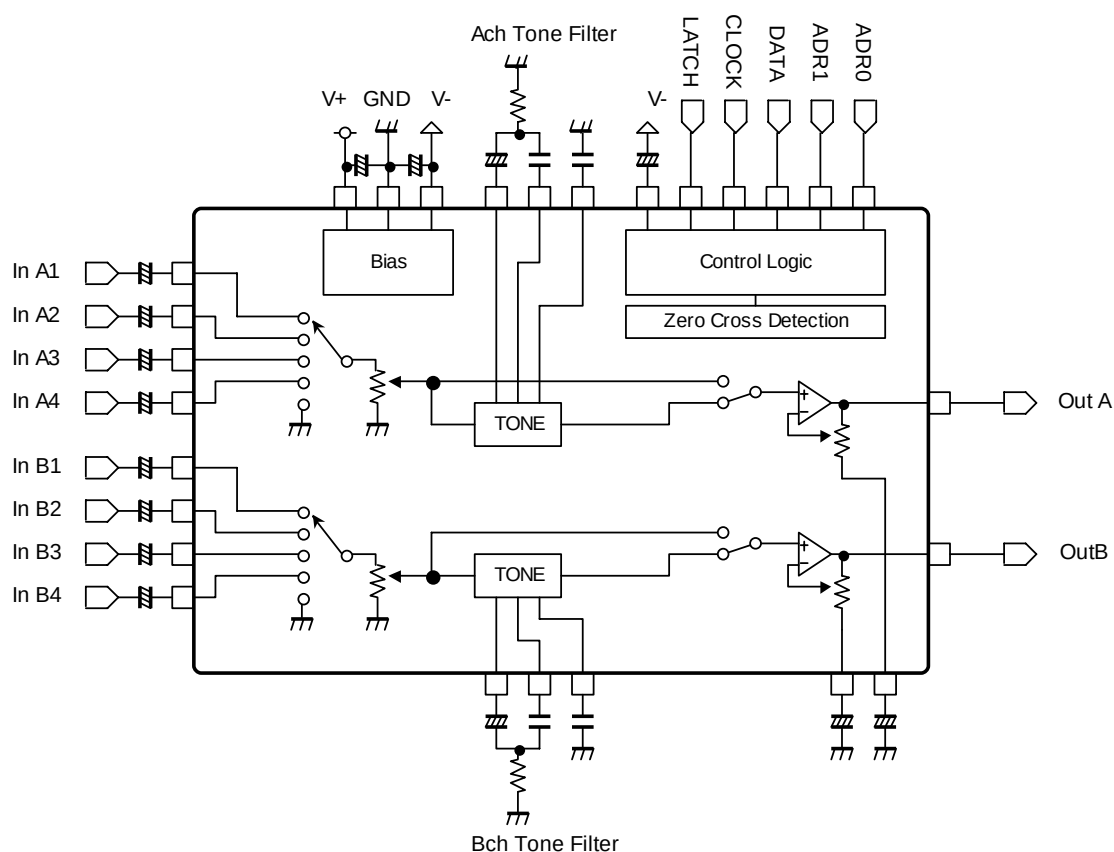


NJW1194V

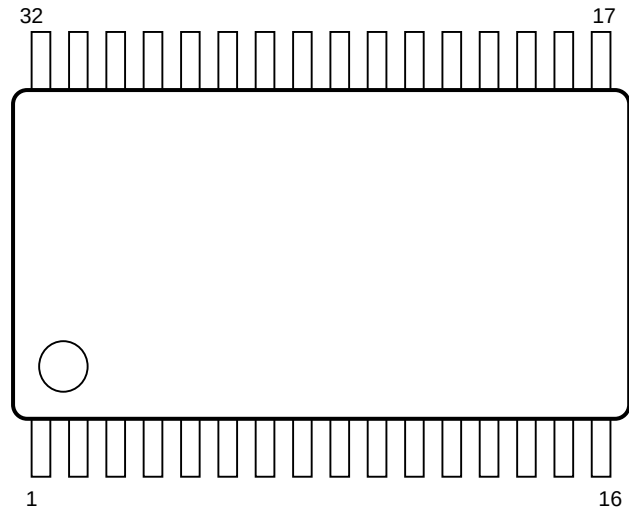
### ■ FEATURES

- |                          |                                               |
|--------------------------|-----------------------------------------------|
| ● Operating Voltage      | $\pm 4.5$ to $\pm 7.5$ V                      |
| ● 3-Wired Serial Control | Chip Address Select Function                  |
| ● Low output noise       | -117dBVtyp.                                   |
| ● Low THD                | 0.0015%typ. ( $V_{in}=2V_{rms}$ , $VOL=0dB$ ) |
| ● Input Selector(X4)     |                                               |
| ● Volume                 | +31.5 to -95.0dB / 0.5dBstep, MUTE            |
| ● Tone Control           | 0 to $\pm 10$ dB/1dBstep                      |
| ● Channel Separation     | -120dBtyp.                                    |
| ● Zero Cross Detection   |                                               |
| ● Bi-CMOS Technology     |                                               |
| ● Package Outline        | SSOP32                                        |

### ■ BLOCK DIAGRAM



## ■ PIN FUNCTION



| No. | SYMBOL    | FUNCTION                                  | No. | SYMBOL    | FUNCTION                                  |
|-----|-----------|-------------------------------------------|-----|-----------|-------------------------------------------|
| 1   | InA1      | Ach Input 1                               | 17  | Tone_Ba2b | Bch Bass Filter Terminal 2                |
| 2   | InA2      | Ach Input 2                               | 18  | Tone_Ba1b | Bch Bass Filter Terminal 1                |
| 3   | InA3      | Ach Input 3                               | 19  | Tone_Tr1b | Bch Treble Filter Terminal 1              |
| 4   | InA4      | Ach Input 4                               | 20  | GND       | Ground                                    |
| 5   | GND       | Ground                                    | 21  | V -       | Power Supply (-)                          |
| 6   | DCCAP_A   | Switching noise rejection capacitor (Ach) | 22  | V+        | Power Supply (+)                          |
| 7   | GND       | Ground                                    | 23  | ADR0      | Chip address setting terminal 0           |
| 8   | OutA      | Ach Output                                | 24  | ADR1      | Chip address setting terminal 1           |
| 9   | VDDOUT    | Internal Digital Power Supply output      | 25  | OutB      | Bch Output                                |
| 10  | DATA      | Control data signal input                 | 26  | GND       | Ground                                    |
| 11  | CLOCK     | Clock signal input                        | 27  | DCCAP_B   | Switching noise rejection capacitor (Bch) |
| 12  | LATCH     | Latch signal input                        | 28  | GND       | Ground                                    |
| 13  | GND       | Ground                                    | 29  | InB4      | Bch Input 4                               |
| 14  | Tone_Tr1a | Ach Treble Filter Terminal 1              | 30  | InB3      | Bch Input 3                               |
| 15  | Tone_Ba1a | Ach Bass Filter Terminal 1                | 31  | InB2      | Bch Input 2                               |
| 16  | Tone_Ba2a | Ach Bass Filter Terminal 2                | 32  | InB1      | Bch Input 1                               |

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

| PARAMETER                   | SYMBOL            | RATING                                                                                | UNIT |
|-----------------------------|-------------------|---------------------------------------------------------------------------------------|------|
| Power Supply Voltage        | V <sub>+/V-</sub> | +8/-8                                                                                 | V    |
| Maximum Input Voltage       | V <sub>IM</sub>   | V <sub>+/V-</sub>                                                                     | V    |
| Power Dissipation           | P <sub>D</sub>    | 1000<br>NOTE: EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layer, FR-4) mounting | mW   |
| Operating Temperature Range | Topr              | -40 ~ +85                                                                             | °C   |
| Storage Temperature Range   | Tstg              | -40 ~ +125                                                                            | °C   |

## ■ ELECTRICAL CHARACTERISTICS (Ta=25°C, V<sub>+/V-</sub>=±7V, R<sub>L</sub>=47kΩ, Volume=0dB, TONE=OFF, In:input, Out:output)

| PARAMETER                               | SYMBOL            | TEST CONDITION                                                                                          | MIN. | TYP. | MAX. | UNIT |
|-----------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------|------|------|------|------|
| ◆ Power Supply                          |                   |                                                                                                         |      |      |      |      |
| Operating Voltage                       | V <sub>+/V-</sub> |                                                                                                         | ±4.5 | ±7.0 | ±7.5 | V    |
| Supply Current 1                        | I <sub>CC</sub>   | No signal                                                                                               | -    | 12   | 17   | mA   |
| Supply Current 2                        | I <sub>EE</sub>   | No signal                                                                                               | -    | 12   | 17   | mA   |
| ◆ Input/Output Characteristics (Output) |                   |                                                                                                         |      |      |      |      |
| Maximum Output Voltage                  | V <sub>OM</sub>   | f=1kHz, THD=1%<br>VOL=0dB                                                                               | 3.6  | 4.2  | -    | Vrms |
| Voltage Gain1                           | G <sub>V1</sub>   | V <sub>IN</sub> =2Vrms, f=1kHz<br>VOL=0dB                                                               | -0.5 | 0    | 0.5  | dB   |
| Voltage Gain2                           | G <sub>V2</sub>   | V <sub>IN</sub> =100mVrms, f=1kHz<br>VOL=+15dB                                                          | +14  | +15  | +16  | dB   |
| Voltage Gain Error1                     | ΔG <sub>V1</sub>  | V <sub>IN</sub> =2Vrms, f=1kHz<br>VOL=0dB                                                               | -0.5 | 0    | 0.5  | dB   |
| Voltage Gain Error2                     | ΔG <sub>V2</sub>  | f=1kHz, V <sub>IN</sub> =2Vrms<br>VOL=-60dB                                                             | -1.0 | 0    | 1.0  | dB   |
| Maximum Attenuation                     | A <sub>TT</sub>   | f=1kHz, V <sub>IN</sub> =2Vrms<br>VOL=-95dB, A-weight                                                   | -    | -95  | -    | dB   |
| Mute Level                              | Mute              | f=1kHz, V <sub>IN</sub> =2Vrms<br>VOL=Mute, A-weight                                                    | -    | -120 | -    | dB   |
| Cross Talk 1                            | CT1               | f=1kHz, V <sub>IN</sub> =2Vrms, A-weight<br>VOL=0dB, R <sub>g</sub> =0Ω                                 | -    | -120 | -    | dB   |
| Cross Talk 2                            | CT2               | f=20kHz, V <sub>IN</sub> =2Vrms<br>VOL=0dB, R <sub>g</sub> =0Ω                                          | -    | -100 | -    | dB   |
| Channel Separation 1                    | CS1               | f=1kHz, V <sub>IN</sub> =2Vrms, A-weight<br>VOL=0dB, R <sub>g</sub> =0Ω                                 | -    | -120 | -90  | dB   |
| Channel Separation 2                    | CS2               | f=20kHz, V <sub>IN</sub> =2Vrms<br>VOL=0dB, R <sub>g</sub> =0Ω                                          | -    | -100 | -    | dB   |
| Channel Separation 3                    | CS3               | f=1kHz, V <sub>IN</sub> =2Vrms, A-weight<br>VOL=0dB, R <sub>g</sub> =0Ω<br>TONE=ON<br>(Bass=Treble=0dB) | -    | -110 | -90  | dB   |
| Channel Separation 4                    | CS4               | f=20kHz, V <sub>IN</sub> =2Vrms<br>VOL=0dB, R <sub>g</sub> =0Ω<br>TONE=ON<br>(Bass=Treble=0dB)          | -    | -90  | -    | dB   |
| Input Impedance                         | R <sub>IN</sub>   | Select Channel Input<br>Terminal                                                                        | 15   | 20   | -    | kΩ   |

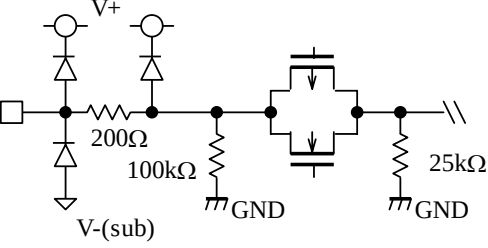
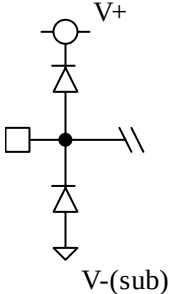
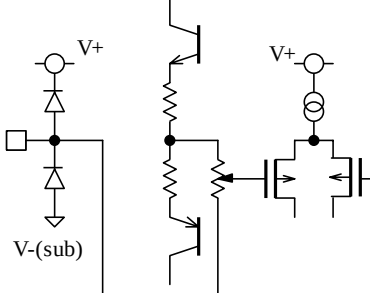
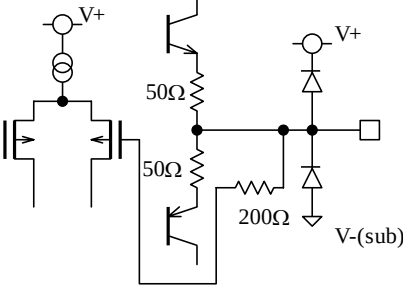
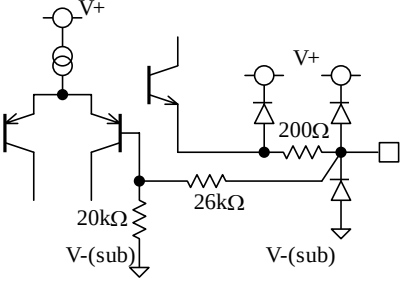
■ **ELECTRICAL CHARACTERISTICS** (Ta=25°C, V<sup>+</sup>/V<sup>-</sup>=±7V, RL=47kΩ, Volume=0dB, TONE=OFF, In:input, Out:output)

| PARAMETER                               | SYMBOL           | TEST CONDITION                                                                                  | MIN. | TYP.            | MAX.          | UNIT          |
|-----------------------------------------|------------------|-------------------------------------------------------------------------------------------------|------|-----------------|---------------|---------------|
| ◆ Input/Output Characteristics (Output) |                  |                                                                                                 |      |                 |               |               |
| Output Noise1                           | V <sub>NO1</sub> | VOL=0dB,<br>Rg=0Ω, A-weight,<br>TONE=ON<br>(Bass=Treble=0dB)                                    | -    | -113<br>(2.2μ)  | -100<br>(10μ) | dBV<br>(Vrms) |
| Output Noise2                           | V <sub>NO2</sub> | VOL=0dB,<br>Rg=0Ω, A-weight,<br>TONE=OFF                                                        | -    | -117<br>(1.41μ) | -             | dBV<br>(Vrms) |
| Total Harmonic Distortion 1             | THD1             | f=1kHz, V <sub>IN</sub> =200mVrms, VOL=0dB,<br>BW=400Hz-30kHz<br>TONE=ON (Bass=Treble=0dB)      | -    | 0.002           | -             | %             |
| Total Harmonic Distortion 2             | THD2             | f=10kHz,<br>V <sub>IN</sub> =200mVrms, VOL=0dB,<br>BW=400Hz-30kHz<br>TONE=ON (Bass=Treble=0dB)  | -    | 0.002           | -             | %             |
| Total Harmonic Distortion 3             | THD3             | f=1kHz, V <sub>IN</sub> =2Vrms, VOL=0dB,<br>BW=400Hz-30kHz<br>TONE=ON (Bass=Treble=0dB)         | -    | 0.0015          | -             | %             |
| Total Harmonic Distortion 4             | THD4             | f=10kHz, V <sub>IN</sub> =2Vrms, VOL=0dB,<br>BW=400Hz-30kHz<br>TONE=ON (Bass=Treble=0dB)        | -    | 0.005           | -             | %             |
| Total Harmonic Distortion 5             | THD5             | f=1kHz,<br>V <sub>IN</sub> =200mVrms, VOL=+15dB,<br>BW=400Hz-30kHz<br>TONE=ON (Bass=Treble=0dB) | -    | 0.002           | -             | %             |
| Total Harmonic Distortion 6             | THD6             | f=10kHz, V <sub>IN</sub> =200mVrms,<br>VOL=+15dB, BW=400Hz-30kHz<br>TONE=ON (Bass=Treble=0dB)   | -    | 0.002           | -             | %             |
| Total Harmonic Distortion 7             | THD7             | f=1kHz, V <sub>IN</sub> =2Vrms, VOL=-18dB,<br>BW=400Hz-30kHz<br>TONE=ON (Bass=Treble=0dB)       | -    | 0.002           | 0.02          | %             |
| Total Harmonic Distortion 8             | THD8             | f=10kHz, V <sub>IN</sub> =2Vrms, VOL=-18dB,<br>BW=400Hz-30kHz<br>TONE=ON (Bass=Treble=0dB)      | -    | 0.002           | -             | %             |

■ **ELECTRICAL CHARACTERISTICS** (Ta=25°C, V<sup>+</sup>/V<sup>-</sup>=±7V, RL=47kΩ, Volume=0dB, TONE=OFF, In:input, Out:output)

| PARAMETER                      | SYMBOL               | TEST CONDITION                                                          | MIN.  | TYP.  | MAX.           | UNIT |
|--------------------------------|----------------------|-------------------------------------------------------------------------|-------|-------|----------------|------|
| ◆Tone Control Characteristics  |                      |                                                                         |       |       |                |      |
| Treble Voltage Gain 1          | G <sub>VTREB1</sub>  | V <sub>IN</sub> =100mVrms, f=10kHz<br>VOL=0dB, TONE=ON,<br>Treble=0dB   | -2.0  | 0     | 2.0            | dB   |
| Treble Voltage Gain 2          | G <sub>VTREB2</sub>  | V <sub>IN</sub> =100mVrms, f=10kHz<br>VOL=0dB, TONE=ON,<br>Treble=+10dB | 8.0   | 10.0  | 12.0           | dB   |
| Treble Voltage Gain 3          | G <sub>VTREB3</sub>  | V <sub>IN</sub> =100mVrms, f=10kHz<br>VOL=0dB, TONE=ON,<br>Treble=-10dB | -12.0 | -10.0 | -8.0           | dB   |
| Bass Voltage Gain 1            | G <sub>VBASS1</sub>  | V <sub>IN</sub> =100mVrms, f=100Hz<br>VOL=0dB, TONE=ON,<br>Bass=0dB     | -2.0  | 0     | 2.0            | dB   |
| Bass Voltage Gain 2            | G <sub>VBASS 2</sub> | V <sub>IN</sub> =100mVrms, f=100Hz<br>VOL=0dB, TONE=ON,<br>Bass=+10dB   | 8.0   | 10.0  | 12.0           | dB   |
| Bass Voltage Gain 3            | G <sub>VBASS 3</sub> | V <sub>IN</sub> =100mVrms, f=100Hz<br>VOL=0dB, TONE=ON,<br>Bass=-10dB   | -12.0 | -10.0 | -8.0           | dB   |
| ◆Logic Control Characteristics |                      |                                                                         |       |       |                |      |
| High Level Input Voltage       | V <sub>IH</sub>      | DATA, CLOCK, LATCH, ADR0,<br>ADR1                                       | 2.5   | -     | V <sup>+</sup> | V    |
| Low Level Input Voltage        | V <sub>IL</sub>      | DATA, CLOCK, LATCH, ADR0,<br>ADR1                                       | 0     | -     | 1.5            | V    |

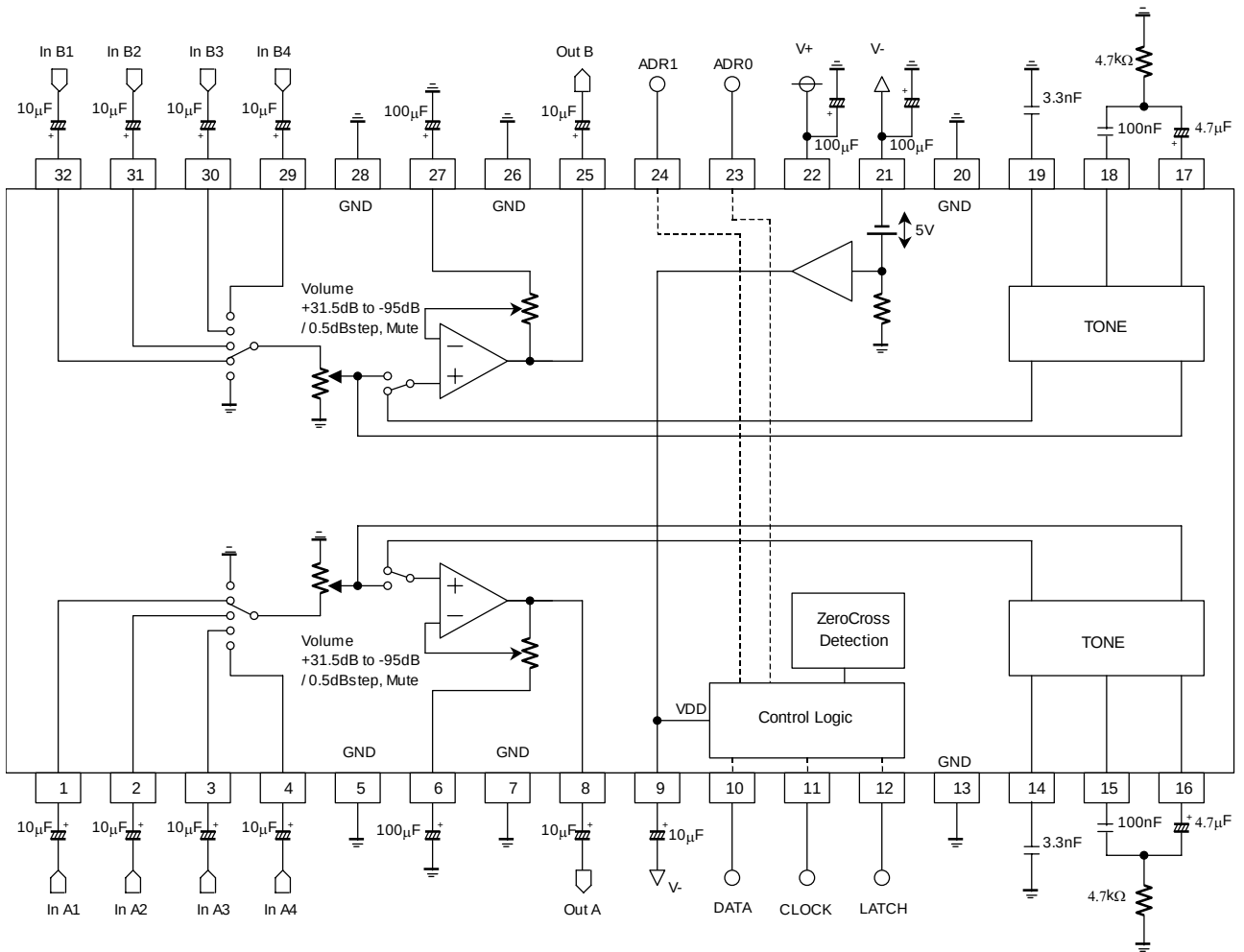
## ■ TERMINAL DESCRIPTION

| PIN NO.                                  | SYMBOL                                                       | FUNCTION                                                                                                             | EQUIVALENT CIRCUIT                                                                   | TERMINAL DC VOLTAGE |
|------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------|
| 1<br>2<br>3<br>4<br>32<br>31<br>30<br>29 | InA1<br>InA2<br>InA3<br>InA4<br>InB1<br>InB2<br>InB3<br>InB4 | Ach Input 1<br>Ach Input 2<br>Ach Input 3<br>Ach Input 4<br>Bch Input 1<br>Bch Input 2<br>Bch Input 3<br>Bch Input 4 |    | 0V                  |
| 5<br>7<br>13<br>20<br>26<br>28           | GND                                                          | Ground                                                                                                               |    | 0V                  |
| 6<br>27                                  | DCCAP_A<br>DCCAP_B                                           | Switching noise rejection capacitor (Ach)<br>Switching noise rejection capacitor (Bch)                               |  | 0V                  |
| 8<br>25                                  | OutA<br>OutB                                                 | Ach Output<br>Bch Output                                                                                             |  | 0V                  |
| 9                                        | VDDOUT                                                       | Internal Digital Power Supply output                                                                                 |  | V-(sub) + 5V        |

## ■ TERMINAL DESCRIPTION

| PIN NO.                    | SYMBOL                                 | FUNCTION                                                                                                                                    | EQUIVALENT CIRCUIT | TERMINAL DC VOLTAGE |
|----------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|
| 10<br>11<br>12<br>23<br>24 | DATA<br>CLOCK<br>LATCH<br>ADR0<br>ADR1 | Control data signal input<br>Clock signal input<br>Latch signal input<br>Chip address setting terminal 0<br>Chip address setting terminal 1 |                    | -                   |
| 14<br>19                   | Tone_Tr1a<br>Tone_Tr1b                 | Ach Treble Filter Terminal 1<br>Bch Treble Filter Terminal 1                                                                                |                    | 0V                  |
| 15<br>18                   | Tone_Ba1a<br>Tone_Ba1b                 | Ach Bass Filter Terminal 1<br>Bch Bass Filter Terminal 1                                                                                    |                    | 0V                  |
| 16<br>17                   | Tone_Ba2a<br>Tone_Ba2b                 | Ach Bass Filter Terminal 2<br>Bch Bass Filter Terminal 2                                                                                    |                    | 0V                  |
| 22                         | V+                                     | Power Supply (+)                                                                                                                            |                    | V+                  |

## ■ APPLICATION CIRCUIT



Note.) When switching TSW(Tone Control By-pass Switch), use MUTE on the set.

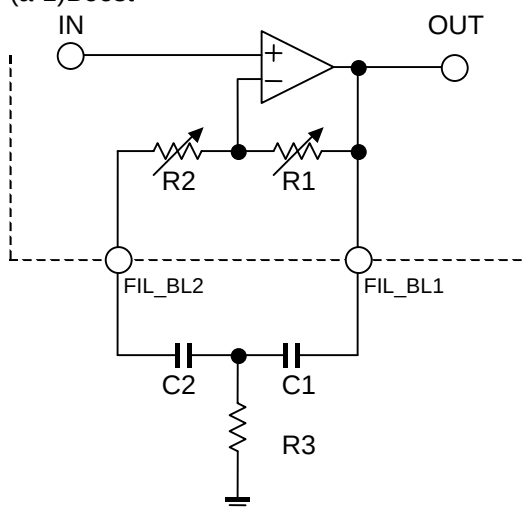


# ■ APPLICATION NOTE

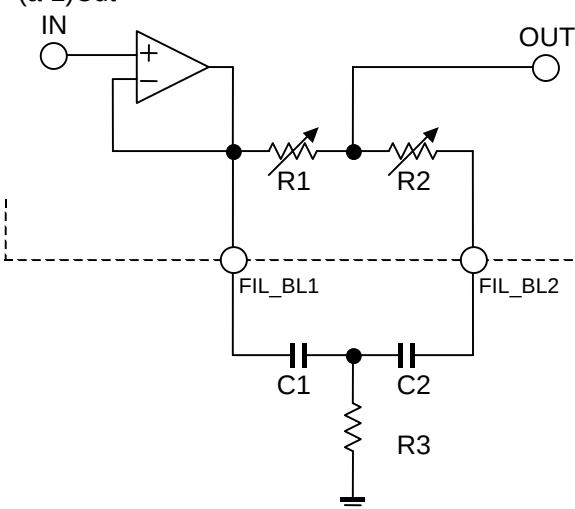
## (1) TONE Control Application suggestions

### (a) Bass Control

#### (a-1) Boost



#### (a-2) Cut



$$f_0 = \frac{1}{2\pi\sqrt{(R1+R2) \times R3 \times C1 \times C2}}$$

$$Q = \frac{\sqrt{(R1+R2) \times R3 \times C1 \times C2}}{R2 \times C2 + R3 \times (C1 + C2)}$$

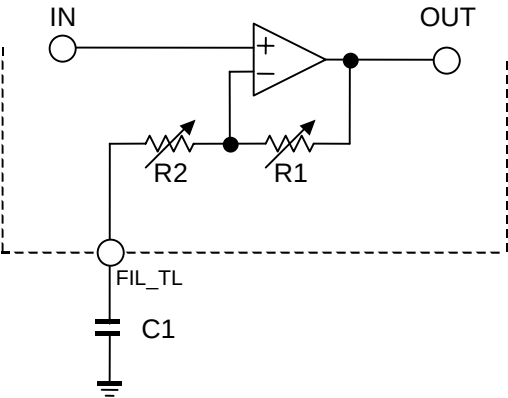
$$G_0 = \pm 20 \text{Log} \frac{(R1 + R2 + R3) \times C2 + R3 \times C1}{C2 \times R2 + (C1 + C2) \times R3}$$

Table.a-1 : Internal resistance in each Gain.

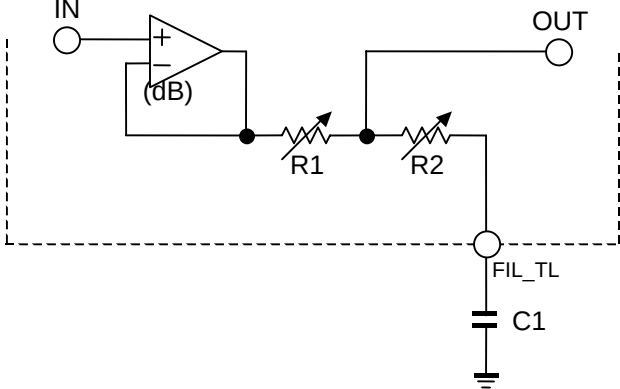
C1=100nF, C2=4.7uF, R3=4.7 kΩ

| Gain  | R1       | R2       |
|-------|----------|----------|
| ±10dB | 32.5 kΩ  | 3.5 kΩ   |
| ±9dB  | 30.1 kΩ  | 5.9 kΩ   |
| ±8dB  | 27.65 kΩ | 8.35 kΩ  |
| ±7dB  | 25.15 kΩ | 10.85 kΩ |
| ±6dB  | 22.45 kΩ | 13.55 kΩ |
| ±5dB  | 19.55 kΩ | 16.45 kΩ |
| ±4dB  | 16.4 kΩ  | 19.6 kΩ  |
| ±3dB  | 12.9 kΩ  | 23.1 kΩ  |
| ±2dB  | 9 kΩ     | 27 kΩ    |
| ±1dB  | 4.75 kΩ  | 31.25 kΩ |

(b) Treble Control  
(b-1) Boost



(b-2)Cut

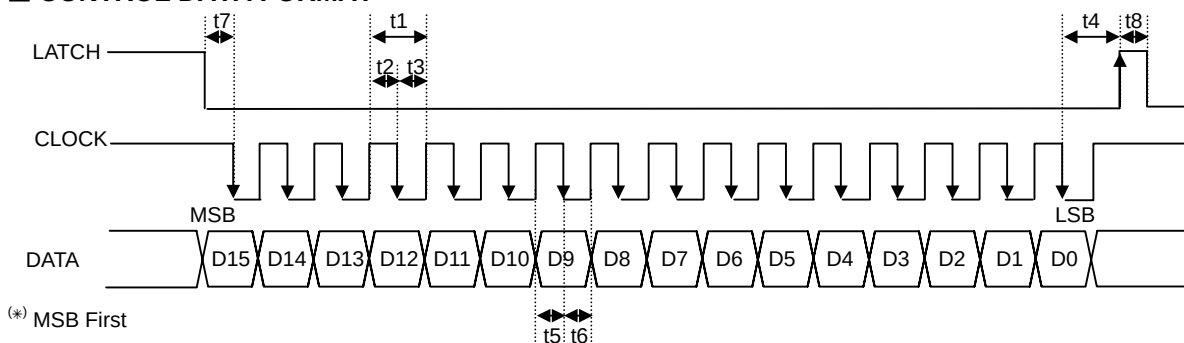


$$G_v = \pm 20 \text{ Log} \left[ 1 + \frac{R1}{R2} \times \frac{1}{\sqrt{1 + (1/(\omega \times C1 \times R2))^2}} \right]$$

Table.b-1 : Internal resistance in each Gain.  
C1=3.3nF

| Gain  | R1       | R2       |
|-------|----------|----------|
| ±10dB | 21.7 kΩ  | 8.4 kΩ   |
| ±9dB  | 20.37 kΩ | 9.73 kΩ  |
| ±8dB  | 18.92 kΩ | 11.18 kΩ |
| ±7dB  | 17.32 kΩ | 12.78 kΩ |
| ±6dB  | 15.56 kΩ | 14.54 kΩ |
| ±5dB  | 13.61 kΩ | 16.49 kΩ |
| ±4dB  | 11.46 kΩ | 18.64 kΩ |
| ±3dB  | 9.06 kΩ  | 21.04 kΩ |
| ±2dB  | 6.36 kΩ  | 23.74 kΩ |
| ±1dB  | 3.36 kΩ  | 26.74 kΩ |

## ■ CONTROL DATA FORMAT



Note.) Set CLOCK in High to prevent incorrect operation during a standby period.

| SYMBOL | PARAMETER                | MIN | TYP | MAX | UNIT |
|--------|--------------------------|-----|-----|-----|------|
| t1     | CLOCK Clock Width        | 4   | -   | -   | μsec |
| t2     | CLOCK Pulse Width (High) | 2   | -   | -   | μsec |
| t3     | CLOCK Pulse Width (Low)  | 2   | -   | -   | μsec |
| t4     | LATCH Rise Hold Time     | 4   | -   | -   | μsec |
| t5     | DATA Setup Time          | 1.6 | -   | -   | μsec |
| t6     | DATA Hold Time           | 1.6 | -   | -   | μsec |
| t7     | CLOCK Setup Time         | 1.6 | -   | -   | μsec |
| t8     | LATCH High Pulse Width   | 1.6 | -   | -   | μsec |

## ■ CONTROL DATA

NJW1194 control data is constructed with 16bits.

| D15  | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7             | D6 | D5 | D4 | D3           | D2 | D1 | D0 |
|------|-----|-----|-----|-----|-----|----|----|----------------|----|----|----|--------------|----|----|----|
| Data |     |     |     |     |     |    |    | Select Address |    |    |    | Chip Address |    |    |    |

MSB

| D15              | D14            | D13 | D12 | D11            | D10 | D9         | D8         | D7         | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------------------|----------------|-----|-----|----------------|-----|------------|------------|------------|----|----|----|----|----|----|----|
| Volume Control 1 |                |     |     |                |     |            |            | 0          | 0  | 0  | 0  | *  | *  | *  | *  |
| Volume Control 2 |                |     |     |                |     |            |            | 0          | 0  | 0  | 1  | *  | *  | *  | *  |
| Don't Care       |                |     |     | Input selector |     |            |            | 0          | 0  | 1  | 0  | *  | *  | *  | *  |
| TC/B             | Treble control |     |     |                |     | TSW        | Don't Care | Don't Care | 0  | 0  | 1  | 1  | *  | *  | *  |
| BC/B             | Bass control   |     |     |                |     | Don't Care | Don't Care | Don't Care | 0  | 1  | 0  | 0  | *  | *  | *  |

LSB

\* Chip address is set by chip address select terminal (ADR) status.

| chip address select terminal |      | Chip Address |    |    |    |
|------------------------------|------|--------------|----|----|----|
| ADR1                         | ADR0 | D3           | D2 | D1 | D0 |
| Low                          | Low  | 0            | 0  | 0  | 0  |
| Low                          | High | 0            | 0  | 0  | 1  |
| High                         | Low  | 0            | 0  | 1  | 0  |
| High                         | High | 0            | 0  | 1  | 1  |

## ■ INITIAL CONDITION

MSB

| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|
| 1   | 1   | 1   | 1   | 1   | 1   | 1  | 1  | 0  | 0  | 0  | 0  | *  | *  | *  | *  |
| 1   | 1   | 1   | 1   | 1   | 1   | 1  | 1  | 0  | 0  | 0  | 1  | *  | *  | *  | *  |
| 0   | 0   | 0   | 0   | 0   | 0   | 0  | 0  | 0  | 0  | 1  | 0  | *  | *  | *  | *  |
| 0   | 0   | 0   | 0   | 0   | 0   | 0  | 0  | 0  | 0  | 1  | 1  | *  | *  | *  | *  |
| 0   | 0   | 0   | 0   | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0  | *  | *  | *  | *  |

Note.) This product starts up by MUTE setting in power "ON". Use it after removing MUTE of each setting.

If any audio signal is inputted in input signal terminal before power "ON", it may cause initial condition abnormality.

In conditions of use such as the above, it prevents that abnormality by setting MUTE before power "OFF"

## ■ DEFINITION OF RESISTOR

◆Volume control1, Volume control2 +31.5dB to -95dB in 0.5dB/step. \*Each volume is controlled independently.

| D15              | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------------------|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|
| Volume control 1 |     |     |     |     |     |    |    | 0  | 0  | 0  | 0  | *  | *  | *  | *  |
| Volume control 2 |     |     |     |     |     |    |    | 0  | 0  | 0  | 1  | *  | *  | *  | *  |

< Volume Control Data >

| Data |     |     |     |     |     |    |    | Setting |
|------|-----|-----|-----|-----|-----|----|----|---------|
| D15  | D14 | D13 | D12 | D11 | D10 | D9 | D8 |         |
| 0    | 0   | 0   | 0   | 0   | 0   | 0  | 0  | Mute    |
| 0    | 0   | 0   | 0   | 0   | 0   | 0  | 1  | +31.5dB |
| 0    | 0   | 0   | 0   | 0   | 0   | 1  | 0  | +31.0dB |
| 0    | 0   | 0   | 0   | 0   | 0   | 1  | 1  | +30.5dB |
| 0    | 0   | 0   | 0   | 0   | 1   | 0  | 0  | +30.0dB |
| 0    | 0   | 0   | 0   | 0   | 1   | 0  | 1  | +29.5dB |
| 0    | 0   | 0   | 0   | 0   | 1   | 1  | 0  | +29.0dB |
| 0    | 0   | 0   | 0   | 0   | 1   | 1  | 1  | +28.5dB |
| 0    | 0   | 0   | 0   | 1   | 0   | 0  | 0  | +28.0dB |
| 0    | 0   | 0   | 0   | 1   | 0   | 0  | 1  | +27.5dB |
| 0    | 0   | 0   | 0   | 1   | 0   | 1  | 0  | +27.0dB |
| 0    | 0   | 0   | 0   | 1   | 0   | 1  | 1  | +26.5dB |
| 0    | 0   | 0   | 0   | 1   | 1   | 0  | 0  | +26.0dB |
| 0    | 0   | 0   | 0   | 1   | 1   | 0  | 1  | +25.5dB |
| 0    | 0   | 0   | 0   | 1   | 1   | 1  | 0  | +25.0dB |
| 0    | 0   | 0   | 0   | 1   | 1   | 1  | 1  | +24.5dB |
| 0    | 0   | 0   | 1   | 0   | 0   | 0  | 0  | +24.0dB |
| 0    | 0   | 0   | 1   | 0   | 0   | 0  | 1  | +23.5dB |
| 0    | 0   | 0   | 1   | 0   | 0   | 1  | 0  | +23.0dB |
| 0    | 0   | 0   | 1   | 0   | 0   | 1  | 1  | +22.5dB |
| 0    | 0   | 0   | 1   | 0   | 1   | 0  | 0  | +22.0dB |
| 0    | 0   | 0   | 1   | 0   | 1   | 0  | 1  | +21.5dB |
| 0    | 0   | 0   | 1   | 0   | 1   | 1  | 0  | +21.0dB |
| 0    | 0   | 0   | 1   | 0   | 1   | 1  | 1  | +20.5dB |
| 0    | 0   | 0   | 1   | 1   | 0   | 0  | 0  | +20.0dB |
| 0    | 0   | 0   | 1   | 1   | 0   | 0  | 1  | +19.5dB |
| 0    | 0   | 0   | 1   | 1   | 0   | 1  | 0  | +19.0dB |
| 0    | 0   | 0   | 1   | 1   | 0   | 1  | 1  | +18.5dB |
| 0    | 0   | 0   | 1   | 1   | 1   | 0  | 0  | +18.0dB |
| 0    | 0   | 0   | 1   | 1   | 1   | 0  | 1  | +17.5dB |
| 0    | 0   | 0   | 1   | 1   | 1   | 1  | 0  | +17.0dB |
| 0    | 0   | 0   | 1   | 1   | 1   | 1  | 1  | +16.5dB |
| 0    | 0   | 1   | 0   | 0   | 0   | 0  | 0  | +16.0dB |
| 0    | 0   | 1   | 0   | 0   | 0   | 0  | 1  | +15.5dB |
| 0    | 0   | 1   | 0   | 0   | 0   | 1  | 0  | +15.0dB |
| 0    | 0   | 1   | 0   | 0   | 0   | 1  | 1  | +14.5dB |
| 0    | 0   | 1   | 0   | 0   | 1   | 0  | 0  | +14.0dB |
| 0    | 0   | 1   | 0   | 0   | 1   | 0  | 1  | +13.5dB |
| 0    | 0   | 1   | 0   | 0   | 1   | 1  | 0  | +13.0dB |
| 0    | 0   | 1   | 0   | 0   | 1   | 1  | 1  | +12.5dB |
| 0    | 0   | 1   | 0   | 1   | 0   | 0  | 0  | +12.0dB |
| 0    | 0   | 1   | 0   | 1   | 0   | 0  | 1  | +11.5dB |
| 0    | 0   | 1   | 0   | 1   | 0   | 1  | 0  | +11.0dB |
| 0    | 0   | 1   | 0   | 1   | 0   | 1  | 1  | +10.5dB |
| 0    | 0   | 1   | 0   | 1   | 1   | 0  | 0  | +10.0dB |
| 0    | 0   | 1   | 0   | 1   | 1   | 0  | 1  | +9.5dB  |
| 0    | 0   | 1   | 0   | 1   | 1   | 1  | 0  | +9.0dB  |
| 0    | 0   | 1   | 0   | 1   | 1   | 1  | 1  | +8.5dB  |
| 0    | 0   | 1   | 1   | 0   | 0   | 0  | 0  | +8.0dB  |

## < Volume Control Data >

| DATA |     |     |     |     |     |    |    | Setting |
|------|-----|-----|-----|-----|-----|----|----|---------|
| D15  | D14 | D13 | D12 | D11 | D10 | D9 | D8 |         |
| 0    | 0   | 1   | 1   | 0   | 0   | 0  | 1  | +7.5dB  |
| 0    | 0   | 1   | 1   | 0   | 0   | 1  | 0  | +7.0dB  |
| 0    | 0   | 1   | 1   | 0   | 0   | 1  | 1  | +6.5dB  |
| 0    | 0   | 1   | 1   | 0   | 1   | 0  | 0  | +6.0dB  |
| 0    | 0   | 1   | 1   | 0   | 1   | 0  | 1  | +5.5dB  |
| 0    | 0   | 1   | 1   | 0   | 1   | 1  | 0  | +5.0dB  |
| 0    | 0   | 1   | 1   | 0   | 1   | 1  | 1  | +4.5dB  |
| 0    | 0   | 1   | 1   | 1   | 0   | 0  | 0  | +4.0dB  |
| 0    | 0   | 1   | 1   | 1   | 0   | 0  | 1  | +3.5dB  |
| 0    | 0   | 1   | 1   | 1   | 0   | 1  | 0  | +3.0dB  |
| 0    | 0   | 1   | 1   | 1   | 0   | 1  | 1  | +2.5dB  |
| 0    | 0   | 1   | 1   | 1   | 1   | 0  | 0  | +2.0dB  |
| 0    | 0   | 1   | 1   | 1   | 1   | 0  | 1  | +1.5dB  |
| 0    | 0   | 1   | 1   | 1   | 1   | 1  | 0  | +1.0dB  |
| 0    | 0   | 1   | 1   | 1   | 1   | 1  | 1  | +0.5dB  |
| 0    | 1   | 0   | 0   | 0   | 0   | 0  | 0  | 0dB     |
| 0    | 1   | 0   | 0   | 0   | 0   | 0  | 1  | -0.5dB  |
| 0    | 1   | 0   | 0   | 0   | 0   | 1  | 0  | -1.0dB  |
| 0    | 1   | 0   | 0   | 0   | 0   | 1  | 1  | -1.5dB  |
| 0    | 1   | 0   | 0   | 0   | 1   | 0  | 0  | -2.0dB  |
| 0    | 1   | 0   | 0   | 0   | 1   | 0  | 1  | -2.5dB  |
| 0    | 1   | 0   | 0   | 0   | 1   | 1  | 0  | -3.0dB  |
| 0    | 1   | 0   | 0   | 0   | 1   | 1  | 1  | -3.5dB  |
| 0    | 1   | 0   | 0   | 1   | 0   | 0  | 0  | -4.0dB  |
| 0    | 1   | 0   | 0   | 1   | 0   | 0  | 1  | -4.5dB  |
| 0    | 1   | 0   | 0   | 1   | 0   | 1  | 0  | -5.0dB  |
| 0    | 1   | 0   | 0   | 1   | 0   | 1  | 1  | -5.5dB  |
| 0    | 1   | 0   | 0   | 1   | 1   | 0  | 0  | -6.0dB  |
| 0    | 1   | 0   | 0   | 1   | 1   | 0  | 1  | -6.5dB  |
| 0    | 1   | 0   | 0   | 1   | 1   | 1  | 0  | -7.0dB  |
| 0    | 1   | 0   | 0   | 1   | 1   | 1  | 1  | -7.5dB  |
| 0    | 1   | 0   | 1   | 0   | 0   | 0  | 0  | -8.0dB  |
| 0    | 1   | 0   | 1   | 0   | 0   | 0  | 1  | -8.5dB  |
| 0    | 1   | 0   | 1   | 0   | 0   | 1  | 0  | -9.0dB  |
| 0    | 1   | 0   | 1   | 0   | 0   | 1  | 1  | -9.5dB  |
| 0    | 1   | 0   | 1   | 0   | 1   | 0  | 0  | -10.0dB |
| 0    | 1   | 0   | 1   | 0   | 1   | 0  | 1  | -10.5dB |
| 0    | 1   | 0   | 1   | 0   | 1   | 1  | 0  | -11.0dB |
| 0    | 1   | 0   | 1   | 0   | 1   | 1  | 1  | -11.5dB |
| 0    | 1   | 0   | 1   | 1   | 0   | 0  | 0  | -12.0dB |
| 0    | 1   | 0   | 1   | 1   | 0   | 0  | 1  | -12.5dB |
| 0    | 1   | 0   | 1   | 1   | 0   | 1  | 0  | -13.0dB |
| 0    | 1   | 0   | 1   | 1   | 0   | 1  | 1  | -13.5dB |
| 0    | 1   | 0   | 1   | 1   | 1   | 0  | 0  | -14.0dB |
| 0    | 1   | 0   | 1   | 1   | 1   | 0  | 1  | -14.5dB |
| 0    | 1   | 0   | 1   | 1   | 1   | 1  | 0  | -15.0dB |
| 0    | 1   | 0   | 1   | 1   | 1   | 1  | 1  | -15.5dB |
| 0    | 1   | 1   | 0   | 0   | 0   | 0  | 0  | -16.0dB |
| 0    | 1   | 1   | 0   | 0   | 0   | 0  | 1  | -16.5dB |
| 0    | 1   | 1   | 0   | 0   | 0   | 1  | 0  | -17.0dB |
| 0    | 1   | 1   | 0   | 0   | 0   | 1  | 1  | -17.5dB |
| 0    | 1   | 1   | 0   | 0   | 1   | 0  | 0  | -18.0dB |
| 0    | 1   | 1   | 0   | 0   | 1   | 0  | 1  | -18.5dB |
| 0    | 1   | 1   | 0   | 0   | 1   | 1  | 0  | -19.0dB |
| 0    | 1   | 1   | 0   | 0   | 1   | 1  | 1  | -19.5dB |
| 0    | 1   | 1   | 0   | 1   | 0   | 0  | 0  | -20.0dB |
| 0    | 1   | 1   | 0   | 1   | 0   | 0  | 1  | -20.5dB |
| 0    | 1   | 1   | 0   | 1   | 0   | 1  | 0  | -21.0dB |

< Volume Control Data >

| DATA |     |     |     |     |     |    |    | Setting |
|------|-----|-----|-----|-----|-----|----|----|---------|
| D15  | D14 | D13 | D12 | D11 | D10 | D9 | D8 |         |
| 0    | 1   | 1   | 0   | 1   | 0   | 1  | 1  | -21.5dB |
| 0    | 1   | 1   | 0   | 1   | 1   | 0  | 0  | -22.0dB |
| 0    | 1   | 1   | 0   | 1   | 1   | 0  | 1  | -22.5dB |
| 0    | 1   | 1   | 0   | 1   | 1   | 1  | 0  | -23.0dB |
| 0    | 1   | 1   | 0   | 1   | 1   | 1  | 1  | -23.5dB |
| 0    | 1   | 1   | 1   | 0   | 0   | 0  | 0  | -24.0dB |
| 0    | 1   | 1   | 1   | 0   | 0   | 0  | 1  | -24.5dB |
| 0    | 1   | 1   | 1   | 0   | 0   | 1  | 0  | -25.0dB |
| 0    | 1   | 1   | 1   | 0   | 0   | 1  | 1  | -25.5dB |
| 0    | 1   | 1   | 1   | 0   | 1   | 0  | 0  | -26.0dB |
| 0    | 1   | 1   | 1   | 0   | 1   | 0  | 1  | -26.5dB |
| 0    | 1   | 1   | 1   | 0   | 1   | 1  | 0  | -27.0dB |
| 0    | 1   | 1   | 1   | 0   | 1   | 1  | 1  | -27.5dB |
| 0    | 1   | 1   | 1   | 1   | 0   | 0  | 0  | -28.0dB |
| 0    | 1   | 1   | 1   | 1   | 0   | 0  | 1  | -28.5dB |
| 0    | 1   | 1   | 1   | 1   | 0   | 1  | 0  | -29.0dB |
| 0    | 1   | 1   | 1   | 1   | 0   | 1  | 1  | -29.5dB |
| 0    | 1   | 1   | 1   | 1   | 1   | 0  | 0  | -30.0dB |
| 0    | 1   | 1   | 1   | 1   | 1   | 0  | 1  | -30.5dB |
| 0    | 1   | 1   | 1   | 1   | 1   | 1  | 0  | -31.0dB |
| 0    | 1   | 1   | 1   | 1   | 1   | 1  | 1  | -31.5dB |
| 1    | 0   | 0   | 0   | 0   | 0   | 0  | 0  | -32.0dB |
| 1    | 0   | 0   | 0   | 0   | 0   | 0  | 1  | -32.5dB |
| 1    | 0   | 0   | 0   | 0   | 0   | 1  | 0  | -33.0dB |
| 1    | 0   | 0   | 0   | 0   | 0   | 1  | 1  | -33.5dB |
| 1    | 0   | 0   | 0   | 0   | 1   | 0  | 0  | -34.0dB |
| 1    | 0   | 0   | 0   | 0   | 1   | 0  | 1  | -34.5dB |
| 1    | 0   | 0   | 0   | 0   | 1   | 1  | 0  | -35.0dB |
| 1    | 0   | 0   | 0   | 0   | 1   | 1  | 1  | -35.5dB |
| 1    | 0   | 0   | 0   | 1   | 0   | 0  | 0  | -36.0dB |
| 1    | 0   | 0   | 0   | 1   | 0   | 0  | 1  | -36.5dB |
| 1    | 0   | 0   | 0   | 1   | 0   | 1  | 0  | -37.0dB |
| 1    | 0   | 0   | 0   | 1   | 0   | 1  | 1  | -37.5dB |
| 1    | 0   | 0   | 0   | 1   | 1   | 0  | 0  | -38.0dB |
| 1    | 0   | 0   | 0   | 1   | 1   | 0  | 1  | -38.5dB |
| 1    | 0   | 0   | 0   | 1   | 1   | 1  | 0  | -39.0dB |
| 1    | 0   | 0   | 0   | 1   | 1   | 1  | 1  | -39.5dB |
| 1    | 0   | 0   | 1   | 0   | 0   | 0  | 0  | -40.0dB |
| 1    | 0   | 0   | 1   | 0   | 0   | 0  | 1  | -40.5dB |
| 1    | 0   | 0   | 1   | 0   | 0   | 1  | 0  | -41.0dB |
| 1    | 0   | 0   | 1   | 0   | 0   | 1  | 1  | -41.5dB |
| 1    | 0   | 0   | 1   | 0   | 1   | 0  | 0  | -42.0dB |
| 1    | 0   | 0   | 1   | 0   | 1   | 0  | 1  | -42.5dB |
| 1    | 0   | 0   | 1   | 0   | 1   | 1  | 0  | -43.0dB |
| 1    | 0   | 0   | 1   | 0   | 1   | 1  | 1  | -43.5dB |
| 1    | 0   | 0   | 1   | 1   | 0   | 0  | 0  | -44.0dB |
| 1    | 0   | 0   | 1   | 1   | 0   | 0  | 1  | -44.5dB |
| 1    | 0   | 0   | 1   | 1   | 0   | 1  | 0  | -45.0dB |
| 1    | 0   | 0   | 1   | 1   | 0   | 1  | 1  | -45.5dB |
| 1    | 0   | 0   | 1   | 1   | 1   | 0  | 0  | -46.0dB |
| 1    | 0   | 0   | 1   | 1   | 1   | 0  | 1  | -46.5dB |
| 1    | 0   | 0   | 1   | 1   | 1   | 1  | 0  | -47.0dB |
| 1    | 0   | 0   | 1   | 1   | 1   | 1  | 1  | -47.5dB |
| 1    | 0   | 1   | 0   | 0   | 0   | 0  | 0  | -48.0dB |
| 1    | 0   | 1   | 0   | 0   | 0   | 0  | 1  | -48.5dB |
| 1    | 0   | 1   | 0   | 0   | 0   | 1  | 0  | -49.0dB |
| 1    | 0   | 1   | 0   | 0   | 0   | 1  | 1  | -49.5dB |
| 1    | 0   | 1   | 0   | 0   | 1   | 0  | 0  | -50.0dB |

## < Volume Control Data >

| DATA |     |     |     |     |     |    |    | Setting |
|------|-----|-----|-----|-----|-----|----|----|---------|
| D15  | D14 | D13 | D12 | D11 | D10 | D9 | D8 |         |
| 1    | 0   | 1   | 0   | 0   | 1   | 0  | 1  | -50.5dB |
| 1    | 0   | 1   | 0   | 0   | 1   | 1  | 0  | -51.0dB |
| 1    | 0   | 1   | 0   | 0   | 1   | 1  | 1  | -51.5dB |
| 1    | 0   | 1   | 0   | 1   | 0   | 0  | 0  | -52.0dB |
| 1    | 0   | 1   | 0   | 1   | 0   | 0  | 1  | -52.5dB |
| 1    | 0   | 1   | 0   | 1   | 0   | 1  | 0  | -53.0dB |
| 1    | 0   | 1   | 0   | 1   | 0   | 1  | 1  | -53.5dB |
| 1    | 0   | 1   | 0   | 1   | 1   | 0  | 0  | -54.0dB |
| 1    | 0   | 1   | 0   | 1   | 1   | 0  | 1  | -54.5dB |
| 1    | 0   | 1   | 0   | 1   | 1   | 1  | 0  | -55.0dB |
| 1    | 0   | 1   | 0   | 1   | 1   | 1  | 1  | -55.5dB |
| 1    | 0   | 1   | 1   | 0   | 0   | 0  | 0  | -56.0dB |
| 1    | 0   | 1   | 1   | 0   | 0   | 0  | 1  | -56.5dB |
| 1    | 0   | 1   | 1   | 0   | 0   | 1  | 0  | -57.0dB |
| 1    | 0   | 1   | 1   | 0   | 0   | 1  | 1  | -57.5dB |
| 1    | 0   | 1   | 1   | 0   | 1   | 0  | 0  | -58.0dB |
| 1    | 0   | 1   | 1   | 0   | 1   | 0  | 1  | -58.5dB |
| 1    | 0   | 1   | 1   | 0   | 1   | 1  | 0  | -59.0dB |
| 1    | 0   | 1   | 1   | 0   | 1   | 1  | 1  | -59.5dB |
| 1    | 0   | 1   | 1   | 1   | 0   | 0  | 0  | -60.0dB |
| 1    | 0   | 1   | 1   | 1   | 0   | 0  | 1  | -60.5dB |
| 1    | 0   | 1   | 1   | 1   | 0   | 1  | 0  | -61.0dB |
| 1    | 0   | 1   | 1   | 1   | 0   | 1  | 1  | -61.5dB |
| 1    | 0   | 1   | 1   | 1   | 1   | 0  | 0  | -62.0dB |
| 1    | 0   | 1   | 1   | 1   | 1   | 0  | 1  | -62.5dB |
| 1    | 0   | 1   | 1   | 1   | 1   | 1  | 0  | -63.0dB |
| 1    | 0   | 1   | 1   | 1   | 1   | 1  | 1  | -63.5dB |
| 1    | 1   | 0   | 0   | 0   | 0   | 0  | 0  | -64.0dB |
| 1    | 1   | 0   | 0   | 0   | 0   | 0  | 1  | -64.5dB |
| 1    | 1   | 0   | 0   | 0   | 0   | 1  | 0  | -65.0dB |
| 1    | 1   | 0   | 0   | 0   | 0   | 1  | 1  | -65.5dB |
| 1    | 1   | 0   | 0   | 0   | 1   | 0  | 0  | -66.0dB |
| 1    | 1   | 0   | 0   | 0   | 1   | 0  | 1  | -66.5dB |
| 1    | 1   | 0   | 0   | 0   | 1   | 1  | 0  | -67.0dB |
| 1    | 1   | 0   | 0   | 0   | 1   | 1  | 1  | -67.5dB |
| 1    | 1   | 0   | 0   | 1   | 0   | 0  | 0  | -68.0dB |
| 1    | 1   | 0   | 0   | 1   | 0   | 0  | 1  | -68.5dB |
| 1    | 1   | 0   | 0   | 1   | 0   | 1  | 0  | -69.0dB |
| 1    | 1   | 0   | 0   | 1   | 0   | 1  | 1  | -69.5dB |
| 1    | 1   | 0   | 0   | 1   | 1   | 0  | 0  | -70.0dB |
| 1    | 1   | 0   | 0   | 1   | 1   | 0  | 1  | -70.5dB |
| 1    | 1   | 0   | 0   | 1   | 1   | 1  | 0  | -71.0dB |
| 1    | 1   | 0   | 0   | 1   | 1   | 1  | 1  | -71.5dB |
| 1    | 1   | 0   | 1   | 0   | 0   | 0  | 0  | -72.0dB |
| 1    | 1   | 0   | 1   | 0   | 0   | 0  | 1  | -72.5dB |
| 1    | 1   | 0   | 1   | 0   | 0   | 1  | 0  | -73.0dB |
| 1    | 1   | 0   | 1   | 0   | 0   | 1  | 1  | -73.5dB |
| 1    | 1   | 0   | 1   | 0   | 1   | 0  | 0  | -74.0dB |
| 1    | 1   | 0   | 1   | 0   | 1   | 0  | 1  | -74.5dB |
| 1    | 1   | 0   | 1   | 0   | 1   | 1  | 0  | -75.0dB |
| 1    | 1   | 0   | 1   | 0   | 1   | 1  | 1  | -75.5dB |
| 1    | 1   | 0   | 1   | 1   | 0   | 0  | 0  | -76.0dB |
| 1    | 1   | 0   | 1   | 1   | 0   | 0  | 1  | -76.5dB |
| 1    | 1   | 0   | 1   | 1   | 0   | 1  | 0  | -77.0dB |
| 1    | 1   | 0   | 1   | 1   | 0   | 1  | 1  | -77.5dB |
| 1    | 1   | 0   | 1   | 1   | 1   | 0  | 0  | -78.0dB |
| 1    | 1   | 0   | 1   | 1   | 1   | 0  | 1  | -78.5dB |
| 1    | 1   | 0   | 1   | 1   | 1   | 1  | 0  | -79.0dB |

< Volume Control Data >

| DATA |     |     |     |     |     |    |    | Setting             |
|------|-----|-----|-----|-----|-----|----|----|---------------------|
| D15  | D14 | D13 | D12 | D11 | D10 | D9 | D8 |                     |
| 1    | 1   | 0   | 1   | 1   | 1   | 1  | 1  | -79.5dB             |
| 1    | 1   | 1   | 0   | 0   | 0   | 0  | 0  | -80.0dB             |
| 1    | 1   | 1   | 0   | 0   | 0   | 0  | 1  | -80.5dB             |
| 1    | 1   | 1   | 0   | 0   | 0   | 1  | 0  | -81.0dB             |
| 1    | 1   | 1   | 0   | 0   | 0   | 1  | 1  | -81.5dB             |
| 1    | 1   | 1   | 0   | 0   | 1   | 0  | 0  | -82.0dB             |
| 1    | 1   | 1   | 0   | 0   | 1   | 0  | 1  | -82.5dB             |
| 1    | 1   | 1   | 0   | 0   | 1   | 1  | 0  | -83.0dB             |
| 1    | 1   | 1   | 0   | 0   | 1   | 1  | 1  | -83.5dB             |
| 1    | 1   | 1   | 0   | 1   | 0   | 0  | 0  | -84.0dB             |
| 1    | 1   | 1   | 0   | 1   | 0   | 0  | 1  | -84.5dB             |
| 1    | 1   | 1   | 0   | 1   | 0   | 1  | 0  | -85.0dB             |
| 1    | 1   | 1   | 0   | 1   | 0   | 1  | 1  | -85.5dB             |
| 1    | 1   | 1   | 0   | 1   | 1   | 0  | 0  | -86.0dB             |
| 1    | 1   | 1   | 0   | 1   | 1   | 0  | 1  | -86.5dB             |
| 1    | 1   | 1   | 0   | 1   | 1   | 1  | 0  | -87.0dB             |
| 1    | 1   | 1   | 0   | 1   | 1   | 1  | 1  | -87.5dB             |
| 1    | 1   | 1   | 1   | 0   | 0   | 0  | 0  | -88.0dB             |
| 1    | 1   | 1   | 1   | 0   | 0   | 0  | 1  | -88.5dB             |
| 1    | 1   | 1   | 1   | 0   | 0   | 1  | 0  | -89.0dB             |
| 1    | 1   | 1   | 1   | 0   | 0   | 1  | 1  | -89.5dB             |
| 1    | 1   | 1   | 1   | 0   | 1   | 0  | 0  | -90.0dB             |
| 1    | 1   | 1   | 1   | 0   | 1   | 0  | 1  | -90.5dB             |
| 1    | 1   | 1   | 1   | 0   | 1   | 1  | 0  | -91.0dB             |
| 1    | 1   | 1   | 1   | 0   | 1   | 1  | 1  | -91.5dB             |
| 1    | 1   | 1   | 1   | 1   | 0   | 0  | 0  | -92.0dB             |
| 1    | 1   | 1   | 1   | 1   | 0   | 0  | 1  | -92.5dB             |
| 1    | 1   | 1   | 1   | 1   | 0   | 1  | 0  | -93.0dB             |
| 1    | 1   | 1   | 1   | 1   | 0   | 1  | 1  | -93.5dB             |
| 1    | 1   | 1   | 1   | 1   | 1   | 0  | 0  | -94.0dB             |
| 1    | 1   | 1   | 1   | 1   | 1   | 0  | 1  | -94.5dB             |
| 1    | 1   | 1   | 1   | 1   | 1   | 1  | 0  | -95.0dB             |
| 1    | 1   | 1   | 1   | 1   | 1   | 1  | 1  | Mute <sup>(*)</sup> |

(\*) : initial setting



◆**Input Selector** : Selector for the stereo inputs

| D15        | D14 | D13 | D12            | D11 | D10 | D9         | D8         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------------|-----|-----|----------------|-----|-----|------------|------------|----|----|----|----|----|----|----|----|
| Don't Care |     |     | Input selector |     |     | Don't Care | Don't Care | 0  | 0  | 1  | 0  | *  | *  | *  | *  |

< Input Selector Data >

| Data |     |     | Setting             |
|------|-----|-----|---------------------|
| D12  | D11 | D10 |                     |
| 0    | 0   | 0   | Mute <sup>(*)</sup> |
| 0    | 0   | 1   | Input1              |
| 0    | 1   | 0   | Input2              |
| 0    | 1   | 1   | Input3              |
| 1    | 0   | 0   | Input4              |

<sup>(\*)</sup>initial setting

◆**TC/B** : Treble Cut / Boost  
**Tone Control Treble** : Treble Gain  
**TSW** : Tone Control By-pass Switch

| D15  | D14            | D13 | D12 | D11 | D10 | D9         | D8         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------|----------------|-----|-----|-----|-----|------------|------------|----|----|----|----|----|----|----|----|
| TC/B | Treble control |     |     |     | TSW | Don't Care | Don't Care | 0  | 0  | 1  | 1  | *  | *  | *  | *  |

< TC/B : Treble Cut / Boost >

| D15 | Setting            |
|-----|--------------------|
| 0   | Cut <sup>(*)</sup> |
| 1   | Boost              |

< Tone Control Treble : Treble Gain >

| Data |     |     |     | Cut                | Boost |
|------|-----|-----|-----|--------------------|-------|
| D14  | D13 | D12 | D11 |                    |       |
| 0    | 0   | 0   | 0   | 0dB <sup>(*)</sup> | 0dB   |
| 0    | 0   | 0   | 1   | -1dB               | 1dB   |
| 0    | 0   | 1   | 0   | -2dB               | 2dB   |
| 0    | 0   | 1   | 1   | -3dB               | 3dB   |
| 0    | 1   | 0   | 0   | -4dB               | 4dB   |
| 0    | 1   | 0   | 1   | -5dB               | 5dB   |
| 0    | 1   | 1   | 0   | -6dB               | 6dB   |
| 0    | 1   | 1   | 1   | -7dB               | 7dB   |
| 1    | 0   | 0   | 0   | -8dB               | 8dB   |
| 1    | 0   | 0   | 1   | -9dB               | 9dB   |
| 1    | 0   | 1   | 0   | -10dB              | 10dB  |

<TSW : Tone Control By-pass Switch >

| D10 | Setting                         |
|-----|---------------------------------|
| 0   | Tone Control OFF <sup>(*)</sup> |
| 1   | Tone Control ON                 |

<sup>(\*)</sup>Initial Setting

◆BC/B : Bass Cut / Boost  
Tone Control Bass : Bass Gain

| D15  | D14          | D13 | D12 | D11 | D10        | D9         | D8         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------|--------------|-----|-----|-----|------------|------------|------------|----|----|----|----|----|----|----|----|
| BC/B | Bass control |     |     |     | Don't Care | Don't Care | Don't Care | 0  | 1  | 0  | 0  | *  | *  | *  | *  |

< BC/B : Bass Cut / Boost >

| D15 | Setting            |
|-----|--------------------|
| 0   | Cut <sup>(*)</sup> |
| 1   | Boost              |

<Tone Control Bass : Bass Gain >

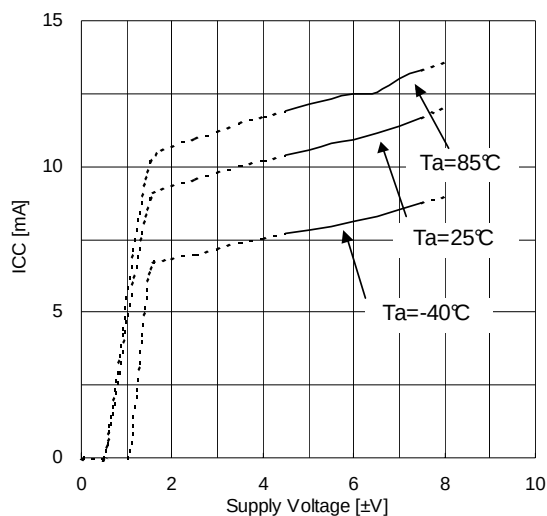
| Data |     |     |     | Cut                | Boost |
|------|-----|-----|-----|--------------------|-------|
| D14  | D13 | D12 | D11 |                    |       |
| 0    | 0   | 0   | 0   | 0dB <sup>(*)</sup> | 0dB   |
| 0    | 0   | 0   | 1   | -1dB               | 1dB   |
| 0    | 0   | 1   | 0   | -2dB               | 2dB   |
| 0    | 0   | 1   | 1   | -3dB               | 3dB   |
| 0    | 1   | 0   | 0   | -4dB               | 4dB   |
| 0    | 1   | 0   | 1   | -5dB               | 5dB   |
| 0    | 1   | 1   | 0   | -6dB               | 6dB   |
| 0    | 1   | 1   | 1   | -7dB               | 7dB   |
| 1    | 0   | 0   | 0   | -8dB               | 8dB   |
| 1    | 0   | 0   | 1   | -9dB               | 9dB   |
| 1    | 0   | 1   | 0   | -10dB              | 10dB  |

<sup>(\*)</sup>Initial Setting

## TYPICAL CHARACTERISTICS

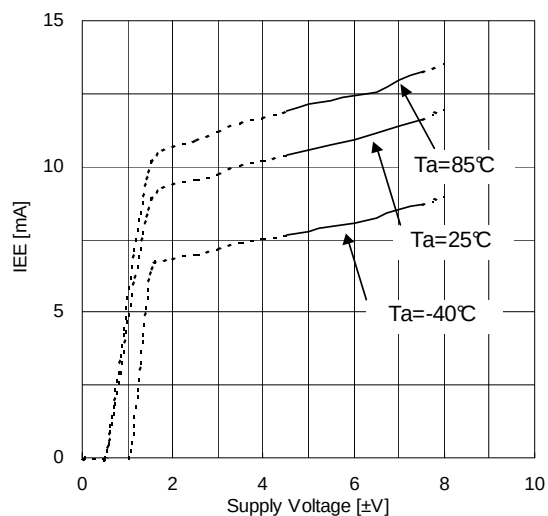
ICC vs Supply Voltage

No signal



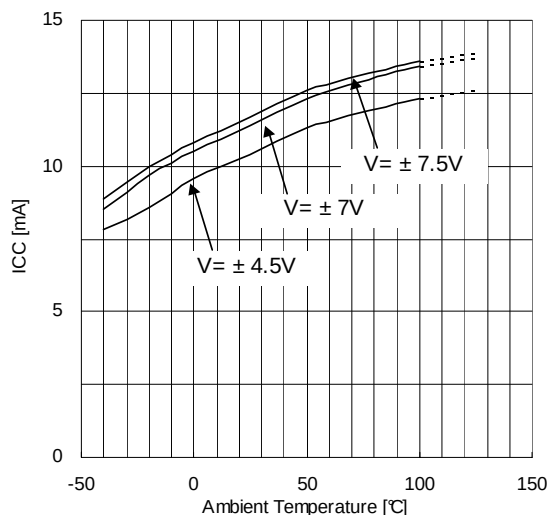
IEE vs Supply Voltage

No signal



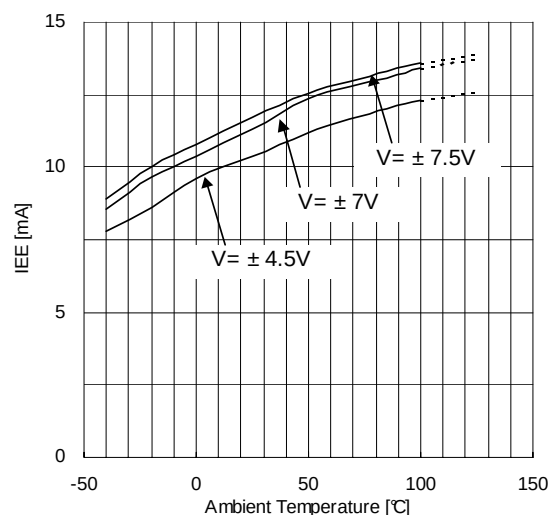
ICC vs Ambient Temperature

No signal



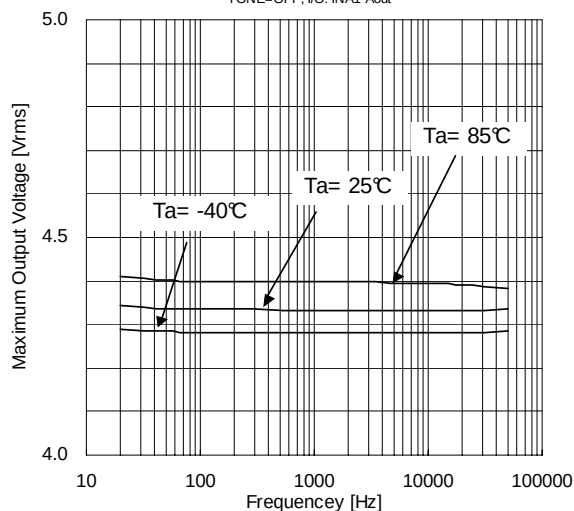
IEE vs Ambient Temperature

No signal



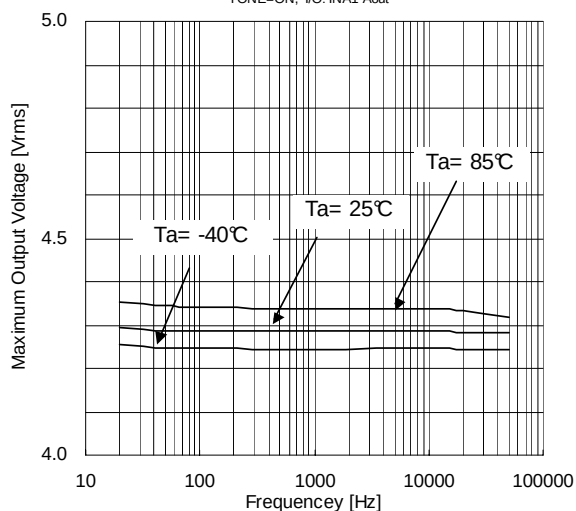
Maximum Output Voltage vs Frequency

V=±7V, THD=1%, VOL=0dB, I/O: INA1-Aout,  
TONE=OFF, I/O: INA1-Aout

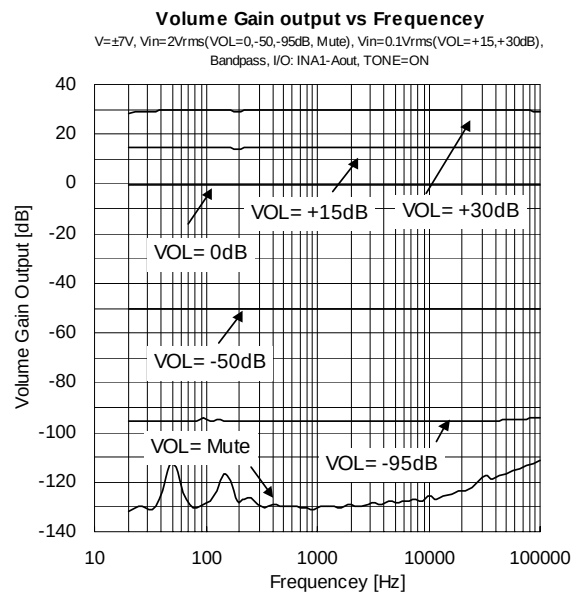
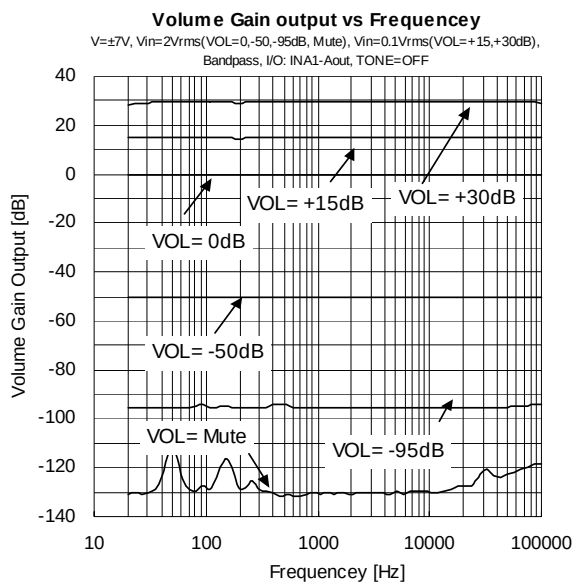
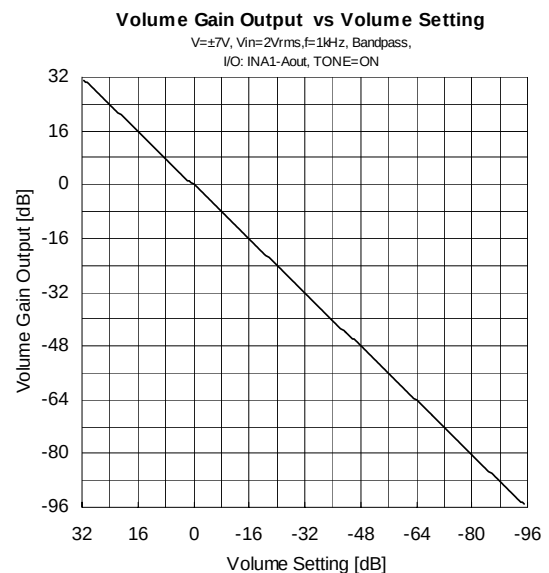
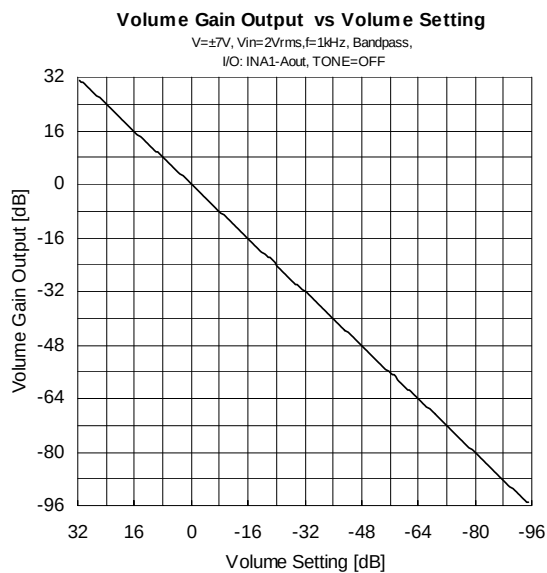
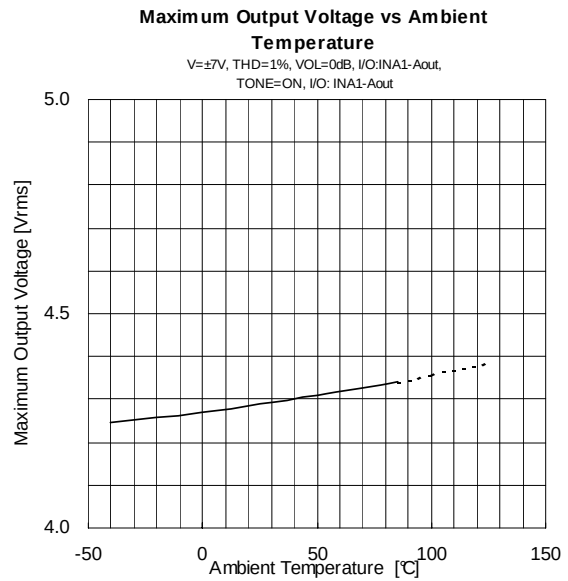
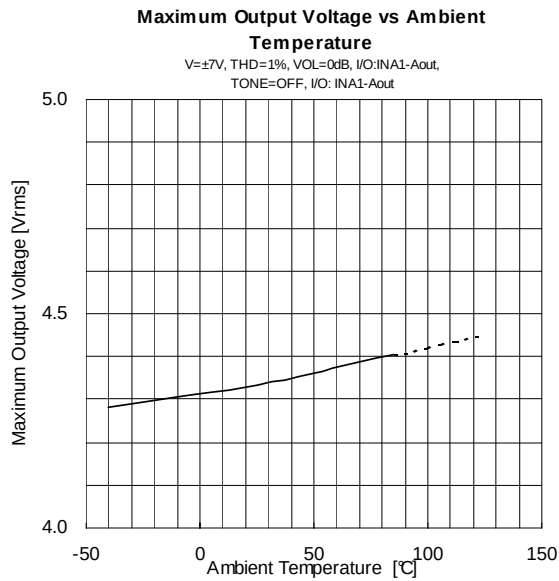


Maximum Output Voltage vs Frequency

V=±7V, THD=1%, VOL=0dB, I/O: INA1-Aout,  
TONE=ON, I/O: INA1-Aout

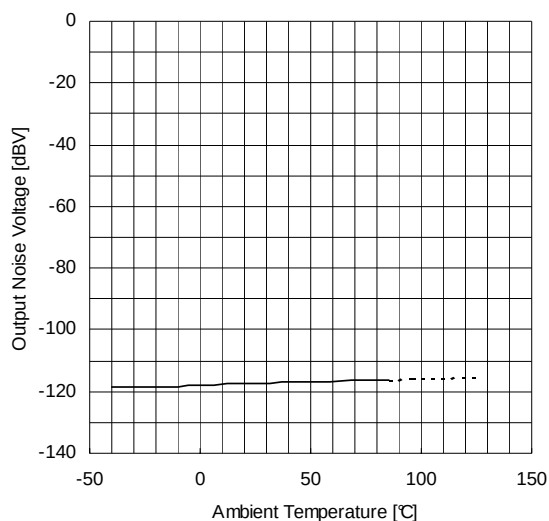


## ■TYPICAL CHARACTERISTICS

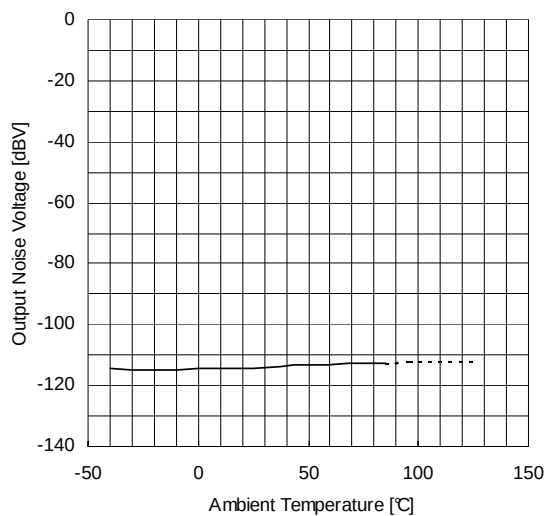


## TYPICAL CHARACTERISTICS

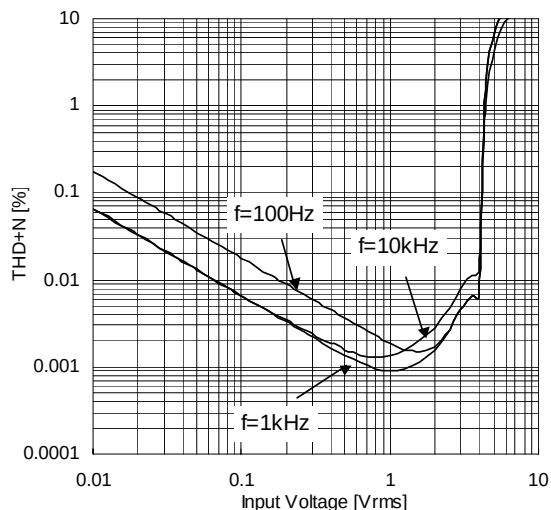
**Output Noise Voltage vs Ambient Temperature**  
V=±7V, THD=1%, A-Weighted, I/O: INA1-Aout, TONE=OFF



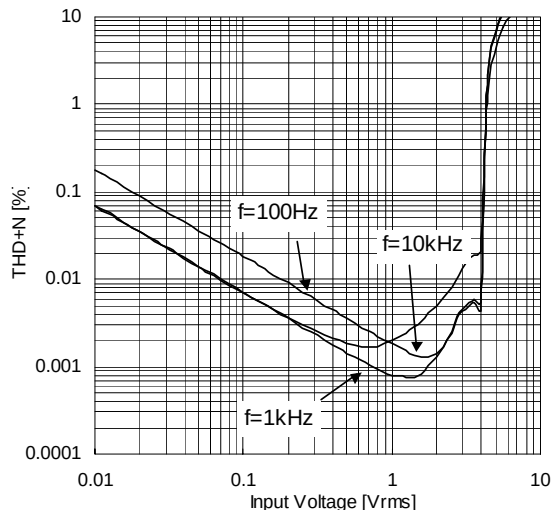
**Output Noise Voltage vs Ambient Temperature**  
V=±7V, THD=1%, A-Weighted, I/O: INA1-Aout, TONE=ON



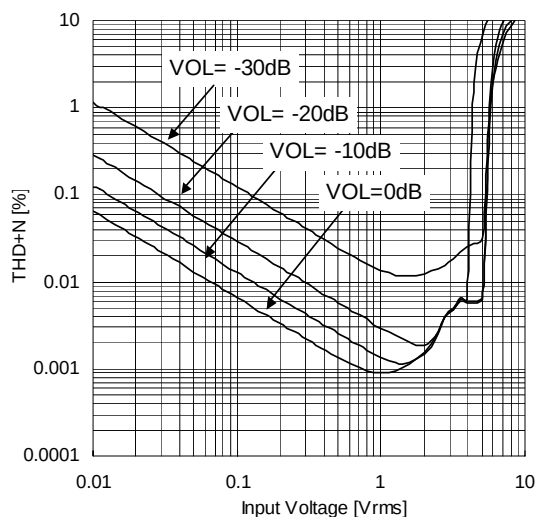
**THD+N vs Input Voltage**  
V=±7V, BW:10-22kHz(f=100Hz), 400-30kHz(f=1kHz, 10kHz),  
I/O: INA1-Aout, TONE=OFF



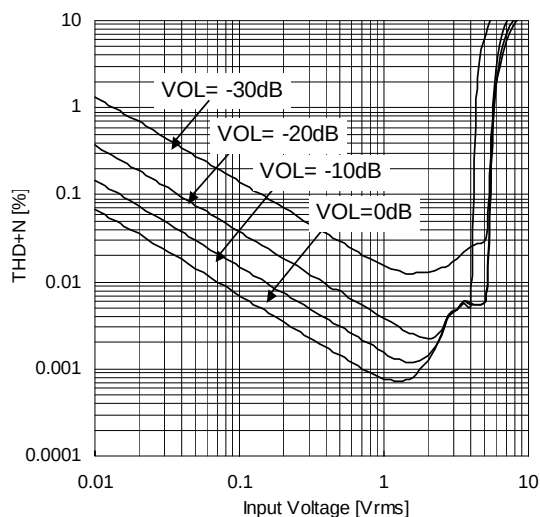
**THD+N vs Input Voltage**  
V=±7V, BW:10-22kHz(f=100Hz), 400-30kHz(f=1kHz, 10kHz),  
I/O: INA1-Aout, TONE=ON



**THD+N vs Input Voltage**  
V=±7V, f=1kHz, BW:400-30kHz, I/O: INA1-Aout, TONE=OFF



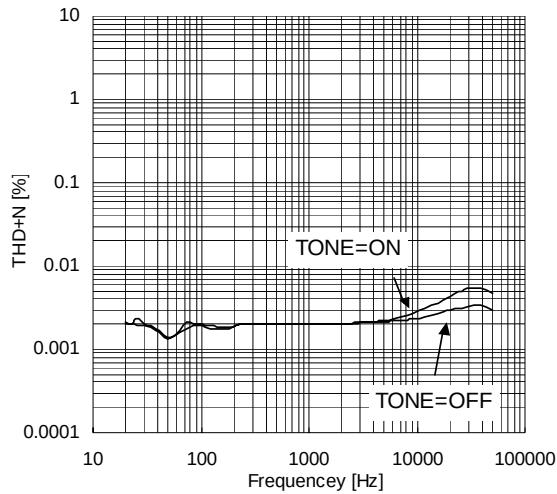
**THD+N vs Input Voltage**  
V=±7V, f=1kHz, BW:400-30kHz, I/O: INA1-Aout, TONE=ON



## TYPICAL CHARACTERISTICS

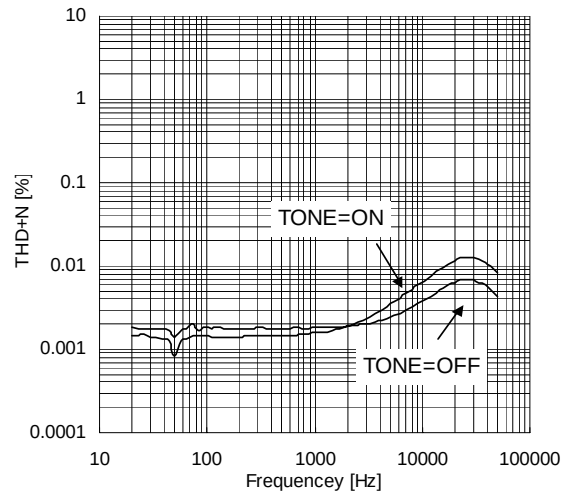
**THD+N vs Frequency**

V=±7V, Vin=1Vrms, VOL=0dB, BW:10-80kHz, I/O: INA1-Aout



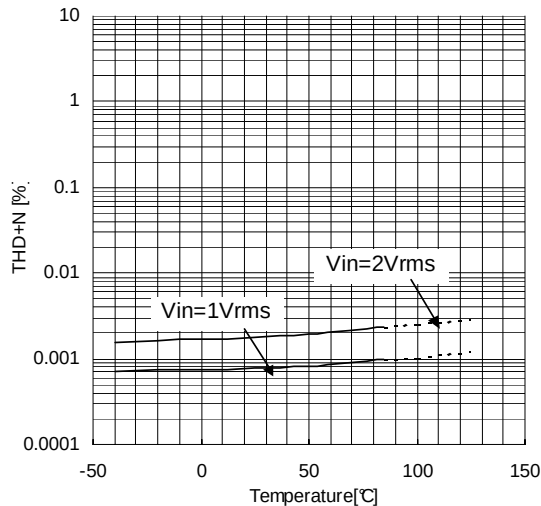
**THD+N vs Frequency**

V=±7V, Vin=2Vrms, VOL=0dB, BW:10-80kHz, I/O: INA1-Aout



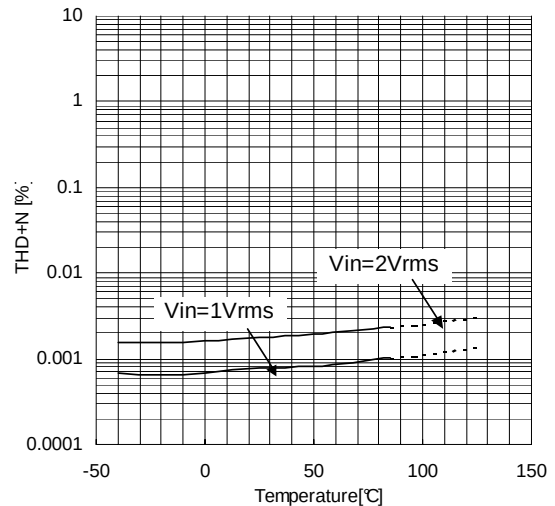
**THD+N vs Ambient Temperature**

V=±7V, f=1kHz, BW:400-30kHz, I/O: INA1-Aout, TONE=OFF



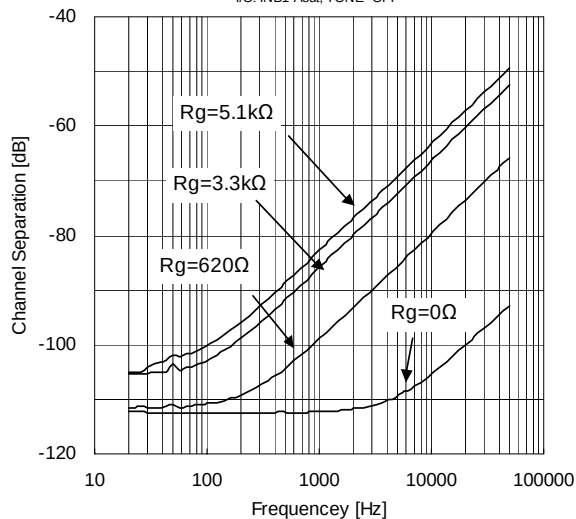
**THD+N vs Ambient Temperature**

V=±7V, f=1kHz, BW:400-30kHz, I/O: INA1-Aout, TONE=ON



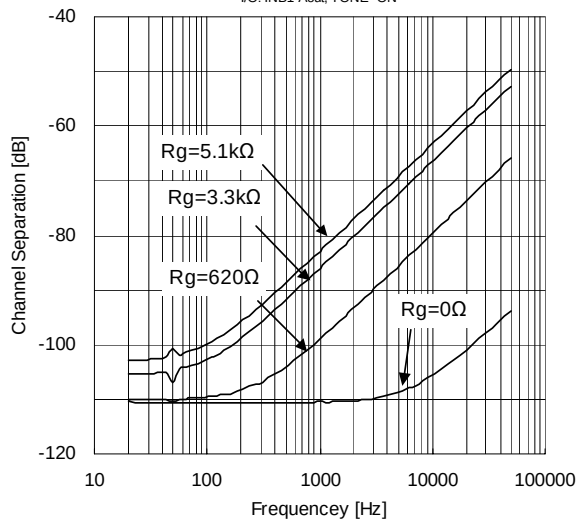
**Channel Separation vs Frequency**

V=±7V, Vin=2Vrms, VOL=0dB, BW:10-80kHz, I/O: INB1-Aout, TONE=OFF



**Channel Separation vs Frequency**

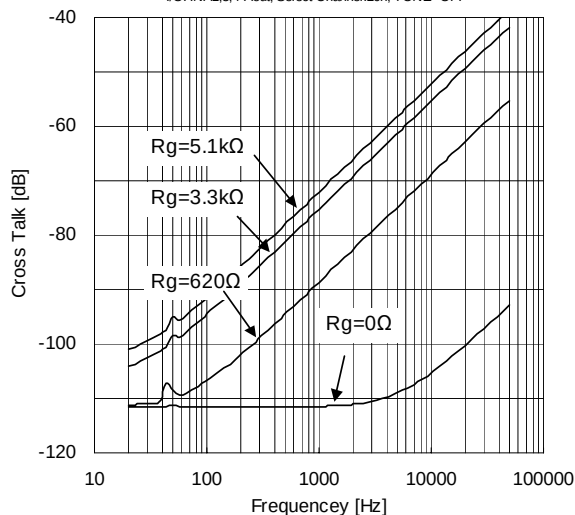
V=±7V, Vin=2Vrms, VOL=0dB, BW:10-80kHz, I/O: INB1-Aout, TONE=ON



## TYPICAL CHARACTERISTICS

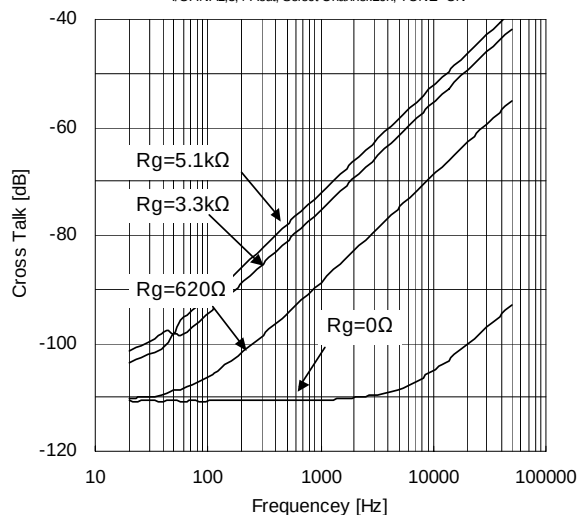
**Cross Talk vs Frequency**

V=±7V, Vin=2Vrms, VOL=0dB, BW:10-80kHz,  
I/O: INA1,3,4-Aout, Select Channel:2ch, TONE=OFF



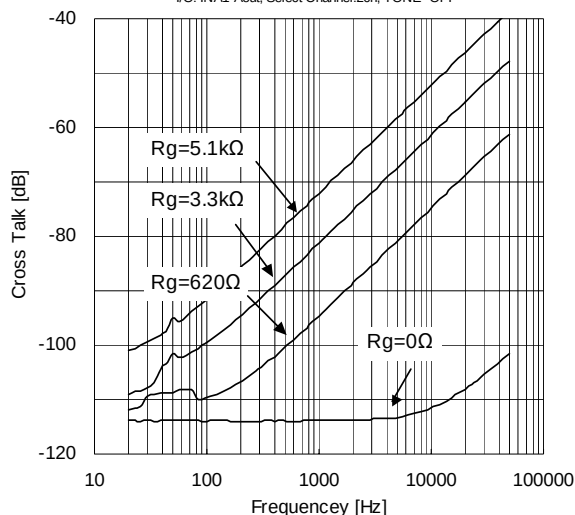
**Cross Talk vs Frequency**

V=±7V, Vin=2Vrms, VOL=0dB, BW:10-80kHz,  
I/O: INA1,3,4-Aout, Select Channel:2ch, TONE=ON



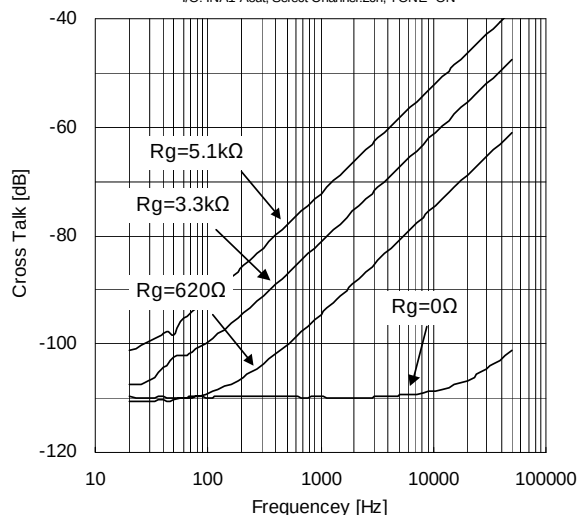
**Cross Talk vs Frequency**

V=±7V, Vin=2Vrms, VOL=0dB, BW:10-80kHz,  
I/O: INA1-Aout, Select Channel:2ch, TONE=OFF



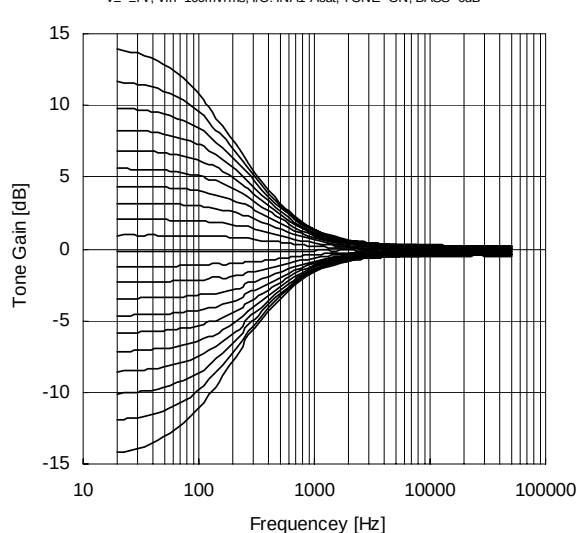
**Cross Talk vs Frequency**

V=±7V, Vin=2Vrms, VOL=0dB, BW:10-80kHz,  
I/O: INA1-Aout, Select Channel:2ch, TONE=ON



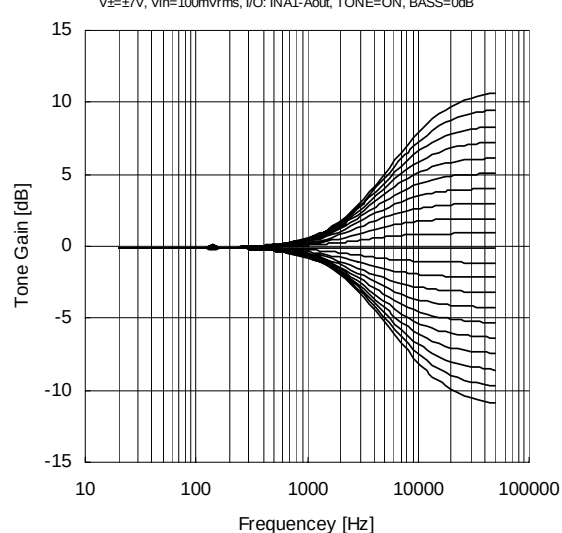
**Tone Control (BASS) vs Frequency**

V±=±7V, Vin=100mVrms, I/O: INA1-Aout, TONE=ON, BASS=0dB

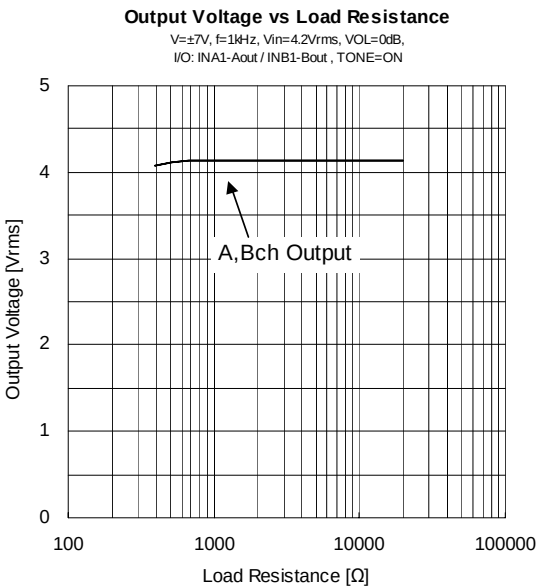
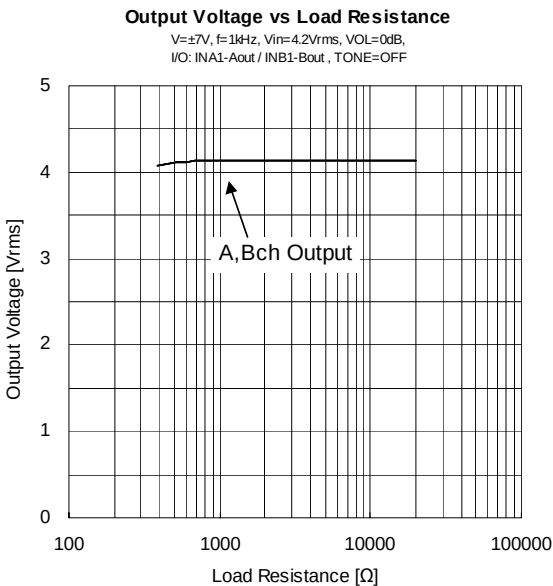
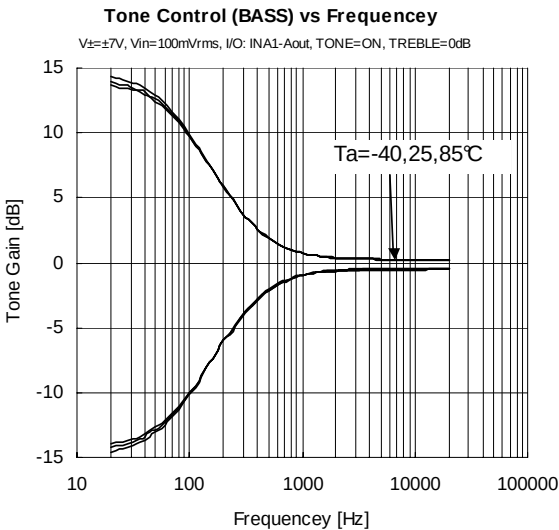
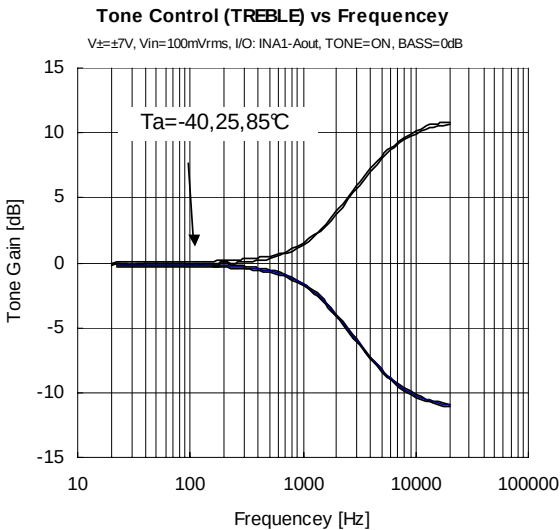
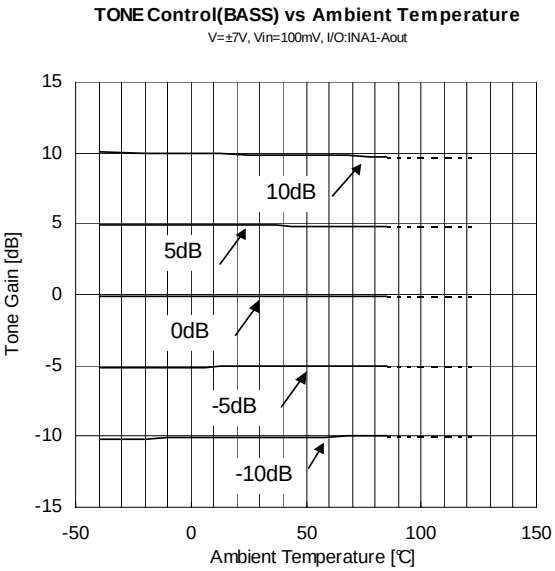
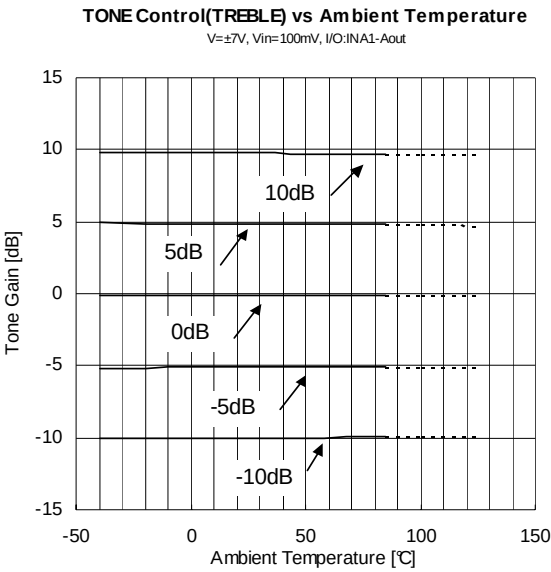


**Tone Control (TREBLE) vs Frequency**

V±=±7V, Vin=100mVrms, I/O: INA1-Aout, TONE=ON, BASS=0dB



■TYPICAL CHARACTERISTICS





[CAUTION]

The specifications on this databook are only given for information , without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.