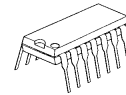


## Headphone Amplifier with Electronic Volume

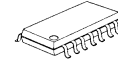
### ■ GENERAL DESCRIPTION

**NJM2777** is a headphone amplifier with electronic volume. It includes widely gain adjustable volume, +20 to -80 dB, and mute function. These are controlled by DC voltage. The **NJM2777** is suitable for headphone output on TV set.

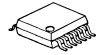
### ■ PACKAGE OUTLINE



NJM2777D



NJM2777M

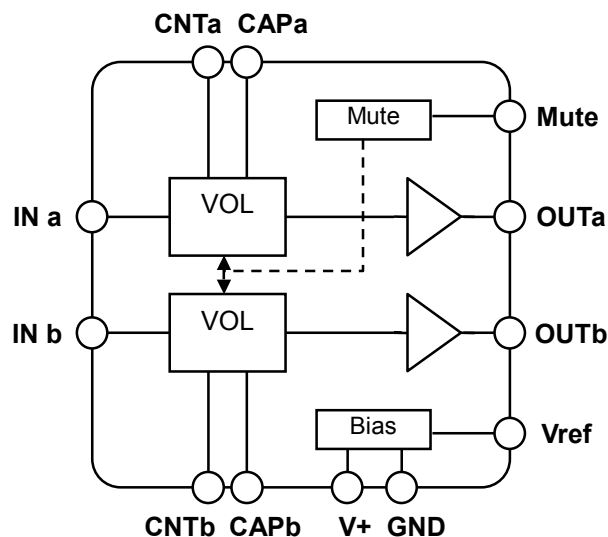


NJM2777V

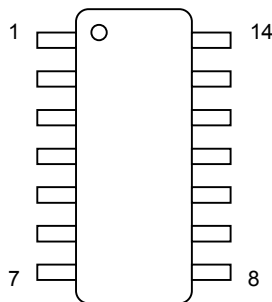
### ■ FEATURES

- Operating Voltage 8 to 10 V
- Electronic Volume +20dB to -80dB
- Mute Function
- Bipolar
- Package Outline DIP14, DMP14, SSOP14

### ■ BLOCK DIAGRAM



### ■ PIN FUNCTION



| No. | SYMBOL | FUNCTION                                                            | No. | SYMBOL | FUNCTION                                                            |
|-----|--------|---------------------------------------------------------------------|-----|--------|---------------------------------------------------------------------|
| 1   | V+     | Power Supply                                                        | 8   | N.C.   | No connecting                                                       |
| 2   | OUTb   | Bch Output                                                          | 9   | Vref   | Reference voltage stabilized capacitor connect terminal             |
| 3   | CNTb   | Bch Volume control voltage input                                    | 10  | INa    | Ach Input                                                           |
| 4   | CAPb   | Bch Volume control click noise absorbing capacitor connect terminal | 11  | CAPa   | Ach Volume control click noise absorbing capacitor connect terminal |
| 5   | INb    | Bch Input                                                           | 12  | CNTa   | Ach Volume control voltage input                                    |
| 6   | Mute   | Mute control                                                        | 13  | OUTa   | Ach Output                                                          |
| 7   | N.C.   | No connecting                                                       | 14  | GND    | Ground                                                              |

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

| PARAMETER                   | SYMBOL         | RATING                                       | UNIT |
|-----------------------------|----------------|----------------------------------------------|------|
| Supply Voltage              | V <sup>+</sup> | 12                                           | V    |
| Power Dissipation           | P <sub>D</sub> | DIP14 : 500<br>DMP14 : 500*<br>SSOP14 : 440* | mW   |
| Operating Temperature Range | Topr           | -20 to +75                                   | °C   |
| Storage Temperature Range   | Tstg           | -40 to +125                                  | °C   |

\*(Note) EIA/JEDEC STANDARD Test board(76.2 x 114.3 x 1.6mm, 2layers, FR-4)mounting

## ■ ELECTRICAL CHARACTERISTICS

(V<sup>+</sup>=9V, V<sub>IN</sub>=-20dBV, f=1kHz, R<sub>L</sub>=100Ω, Gv=0dB, "Mute" terminal =L, Ta=25°C)

### ●POWER SUPPLY

| PARAMETER         | SYMBOL           | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-------------------|------------------|----------------|------|------|------|------|
| Operating Voltage | V <sup>+</sup>   |                | 8    | 9    | 10   | V    |
| Operating Current | I <sub>CC</sub>  | No Signal      | -    | 5    | 8    | mA   |
| Reference Voltage | V <sub>REF</sub> |                | 4    | 4.1  | 4.2  | V    |

### ●AMPLIFIER

| PARAMETER                     | SYMBOL           | TEST CONDITION                                    | MIN.         | TYP.          | MAX.        | UNIT                        |
|-------------------------------|------------------|---------------------------------------------------|--------------|---------------|-------------|-----------------------------|
| Volume Operating Range        | G <sub>EVR</sub> | V <sub>CNTa</sub> , V <sub>CNTb</sub> = 0 to 3.3V | 80           | 100           | -           | dB                          |
| Voltage Gain Channel Balance  | ΔGv              |                                                   | -1.5         | 0             | 1.5         | dB                          |
| Maximum Input Voltage         | V <sub>IM</sub>  | Gv=-10dB<br>THD=3%                                | 8.9<br>(2.8) | 9.5<br>(3.0)  | -           | dBV<br>(V <sub>rms</sub> )  |
| Output Power                  | P <sub>O</sub>   | Gv=10dB, THD=10%                                  | 70           | 100           | -           | mW                          |
| Total Harmonic Distortion     | THD              |                                                   | -            | 0.1           | 1           | %                           |
| Channel Separation            | CS               | Rg=600Ω, Vin = 0dBV                               | 70           | 80            | -           | dB                          |
| Mute Level                    | Mute             | "Mute" terminal=H,<br>Vin = 0dBV                  | -            | -85           | -75         | dB                          |
| Output Noise Voltage 1        | V <sub>NO1</sub> | Rg=0Ω, A-Weighted                                 | -            | -95<br>(18)   | -85<br>(56) | dBV<br>(μV <sub>rms</sub> ) |
| Output Noise Voltage 2        | V <sub>NO2</sub> | "Mute" terminal =H<br>Rg=0Ω, A-Weighted           | -            | -105<br>(5.6) | -95<br>(18) | dBV<br>(μV <sub>rms</sub> ) |
| Power Supply Ripple Rejection | PSRR             | Vripple=-20dBV<br>Rg=0Ω                           | -            | 70            | -           | dB                          |

### ●CONTROL

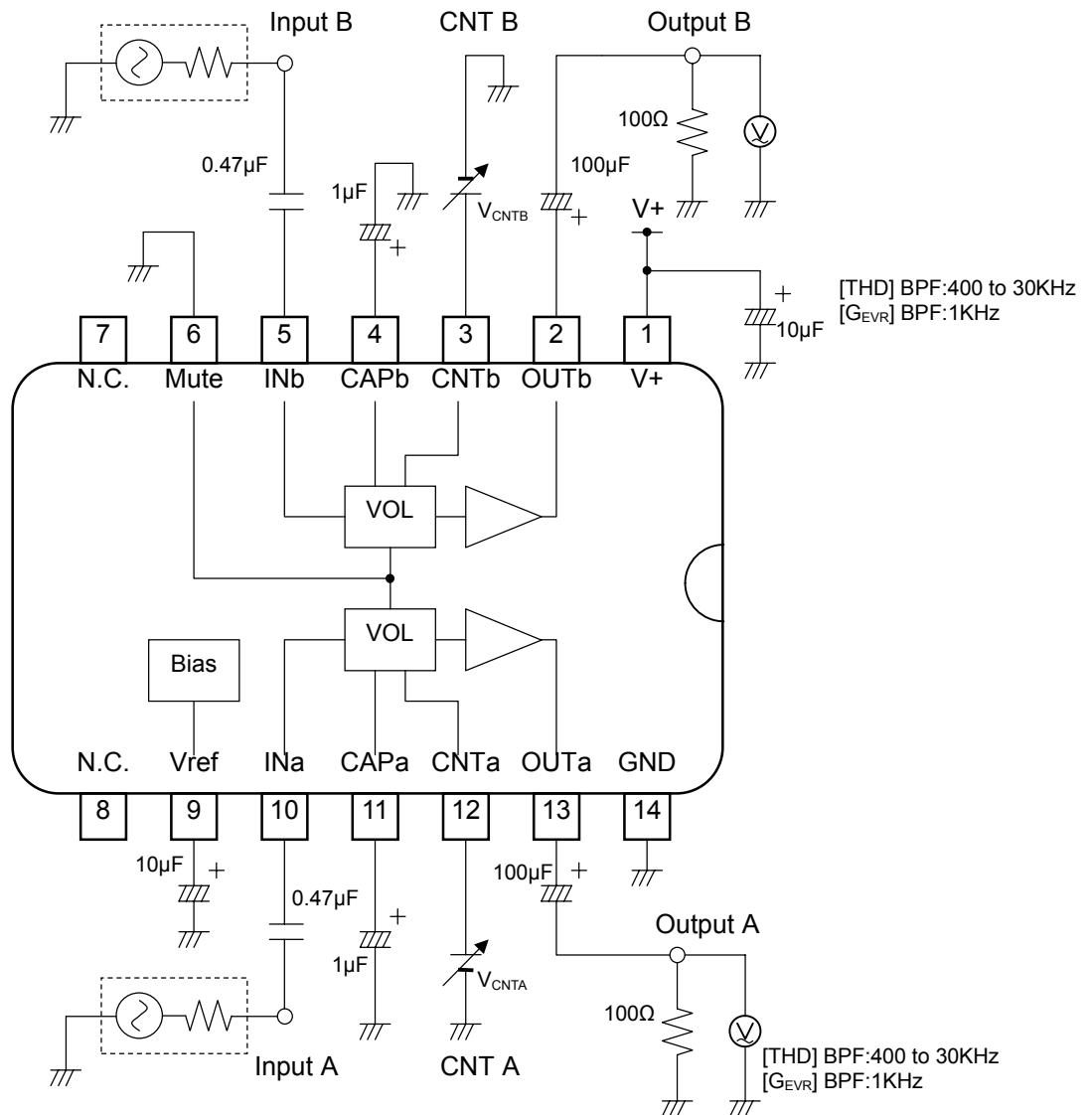
| PARAMETER                | SYMBOL          | TEST CONDITION | MIN. | TYP. | MAX.           | UNIT |
|--------------------------|-----------------|----------------|------|------|----------------|------|
| High Level Input Voltage | V <sub>IH</sub> |                | 2    | -    | V <sup>+</sup> | V    |
| Low Level Input Voltage  | V <sub>IL</sub> |                | 0    | -    | 0.4            | V    |

## ■ CONTROL TERMINAL

| Operating Condition    |        | Control Terminal<br>Mute Terminal | Description       |
|------------------------|--------|-----------------------------------|-------------------|
| Operating<br>Condition | Mute   | H                                 | Mute the signal   |
|                        | Active | L, OPEN                           | Output the signal |

## ■ TEST CIRCUIT

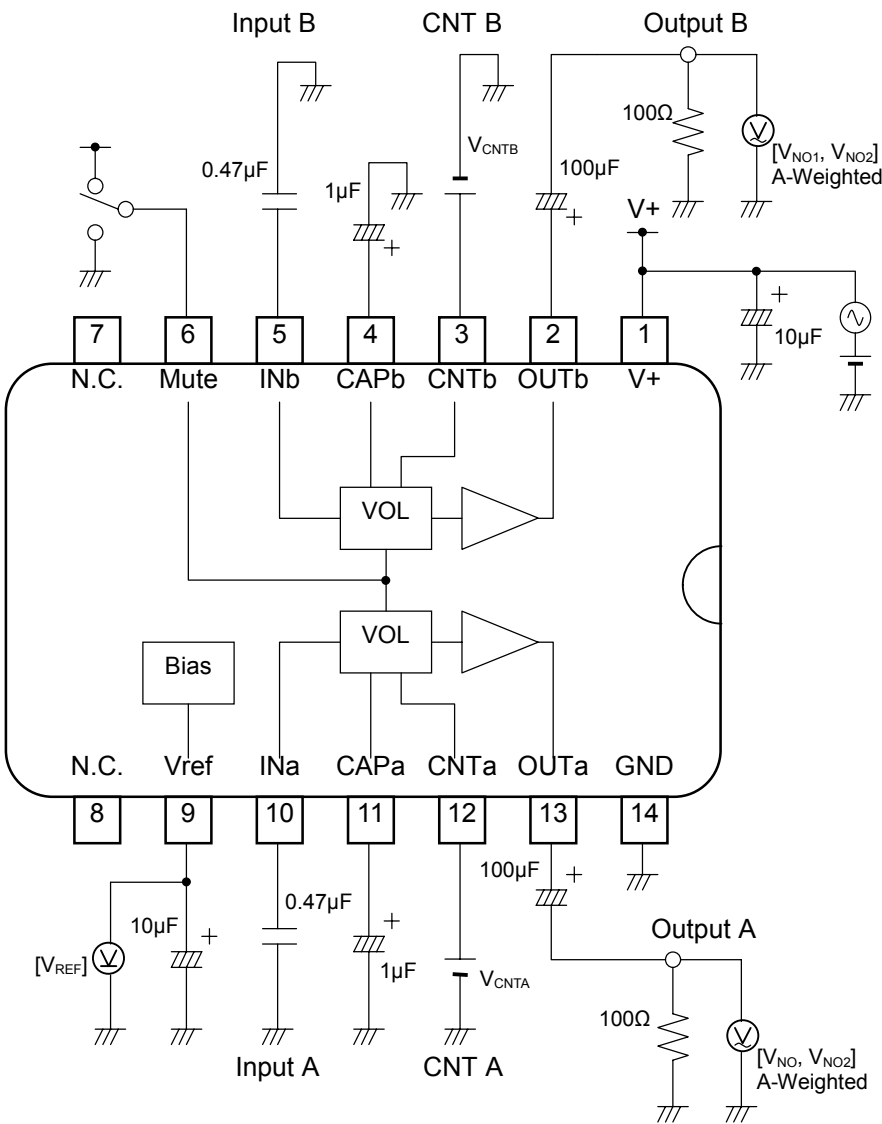
### TEST CIRCUIT1 (THD, GEVR, VIM, PO)



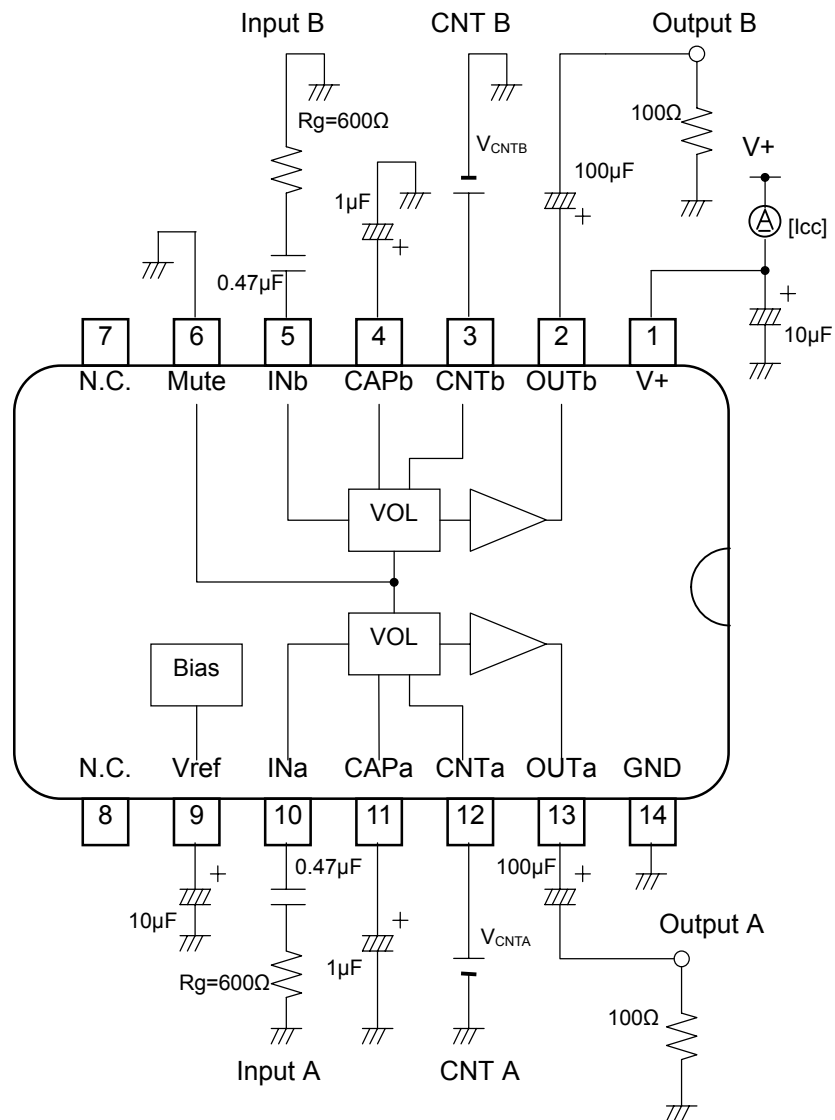
$$\text{Volume Range : GEVR} = 20 \log \frac{V_{o \max}}{V_{o \min}}$$

[ V<sub>omin</sub> : Output voltage at VCNT=0V  
V<sub>omax</sub> : Output voltage at VCNT=3.3V ]

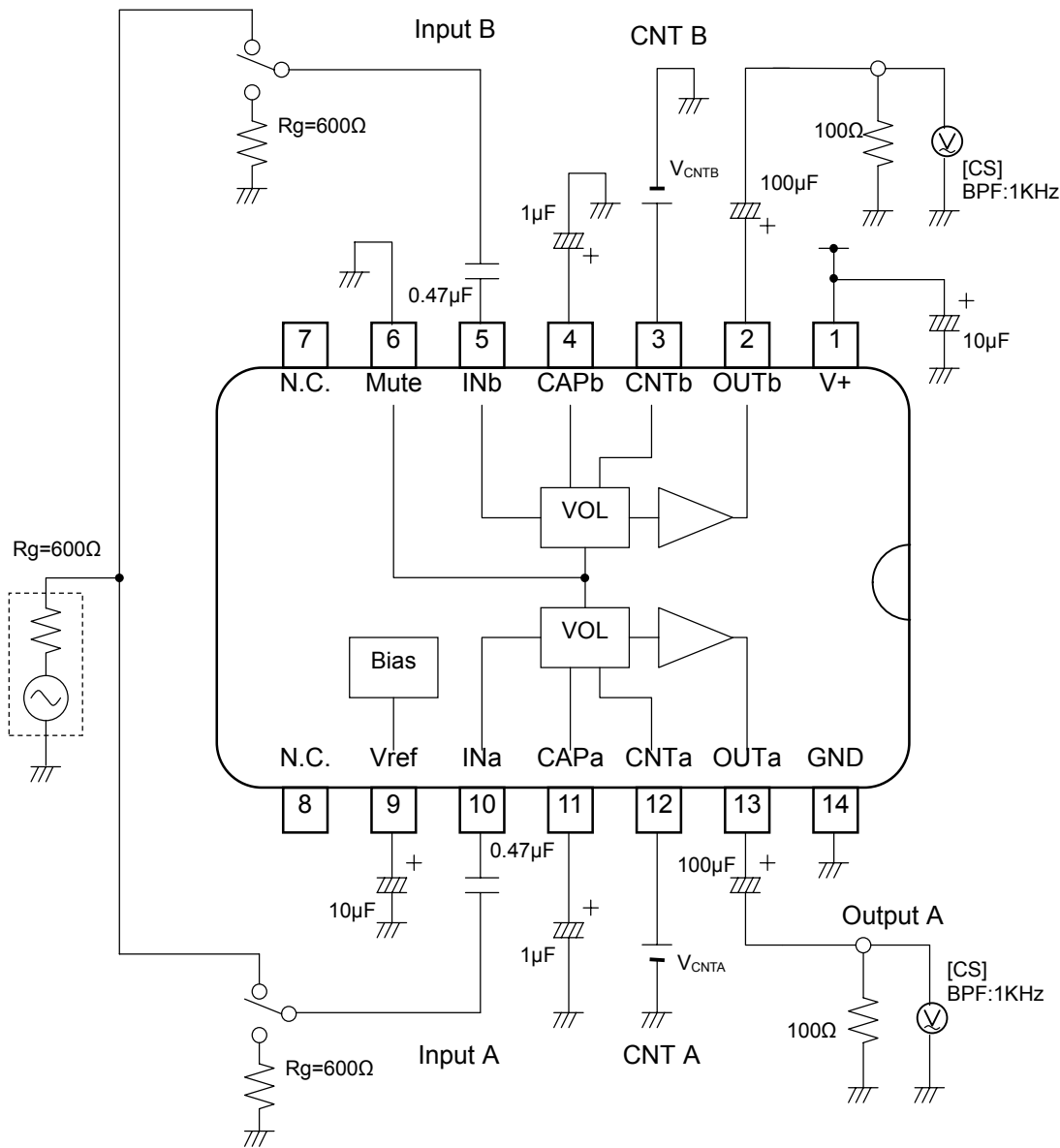
TEST CIRCUIT 2 (VNO1,VNO2,VREF)



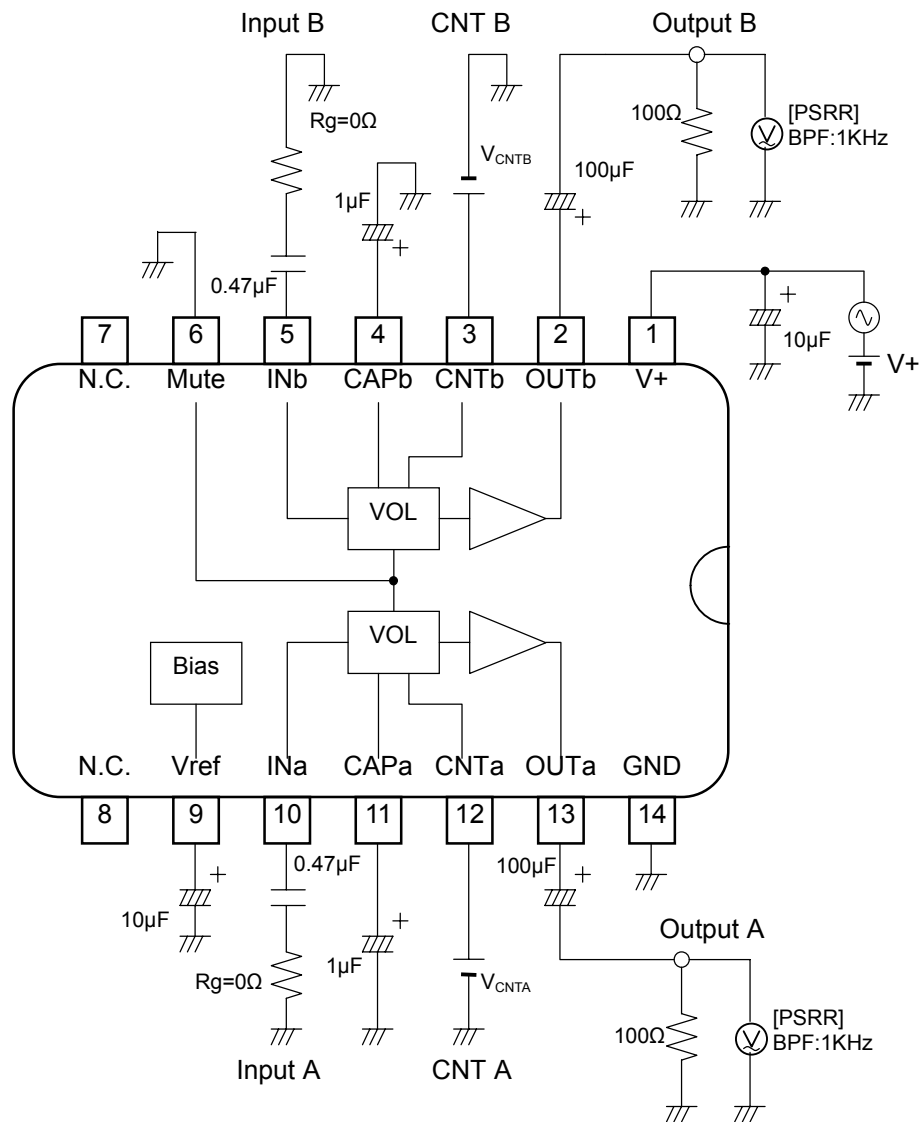
## TEST CIRCUIT 3 (I<sub>cc</sub>)



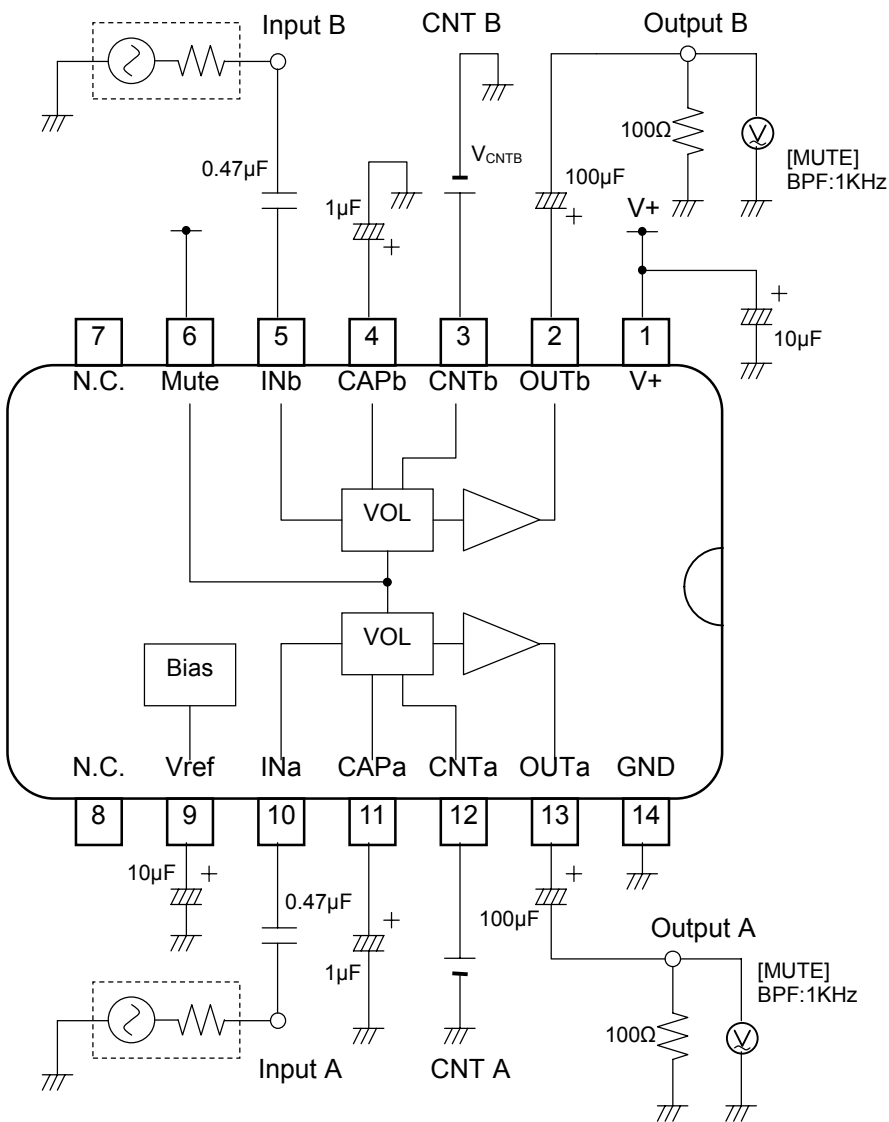
TEST CIRCUIT 4 (CS)



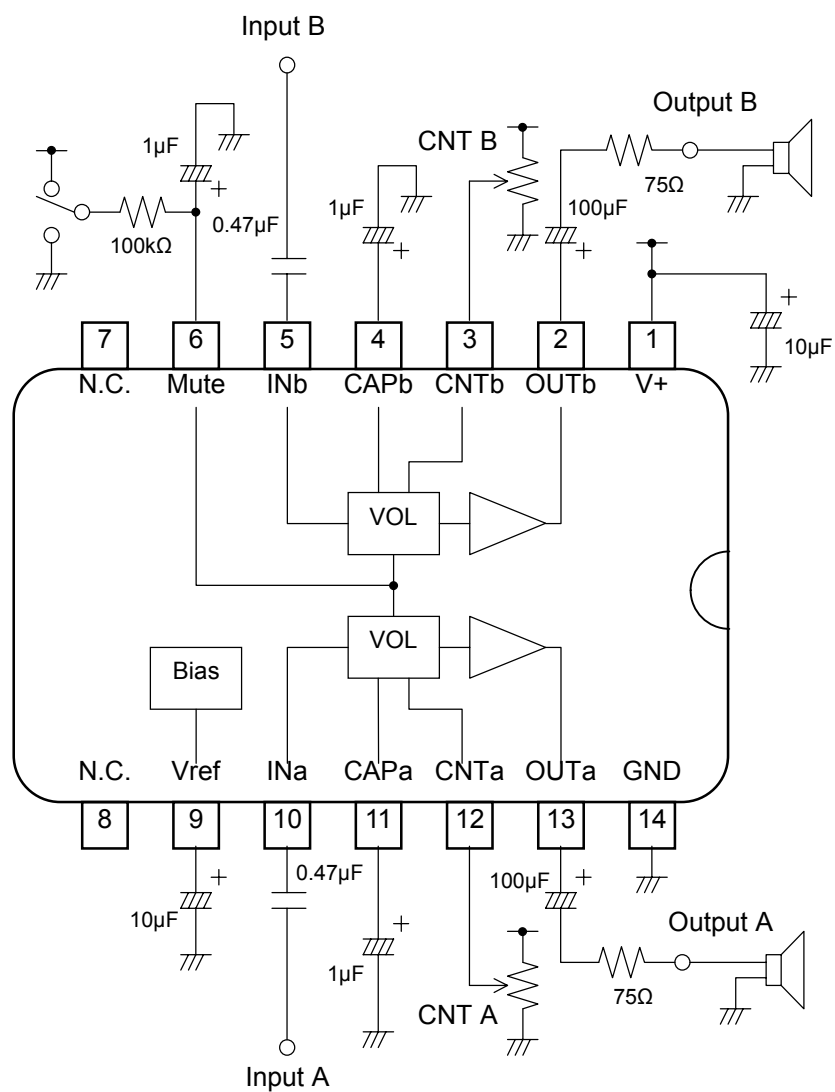
## TEST CIRCUIT 5 (PSRR)



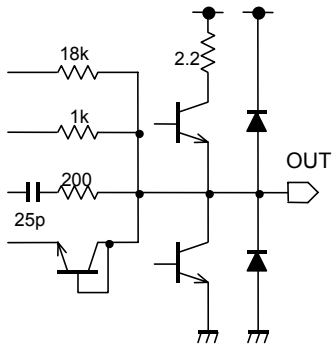
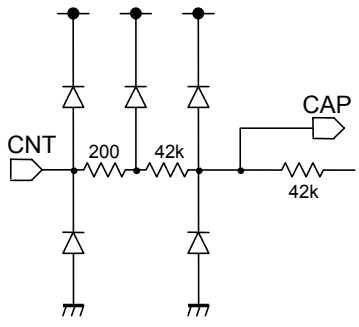
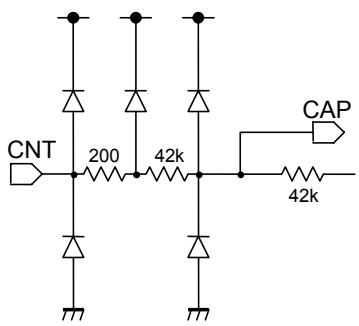
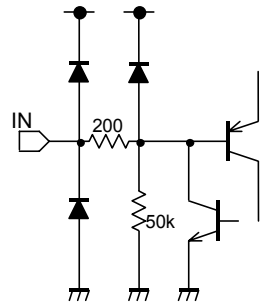
TEST CIRCUIT 6 (MUTE)



## APPLICATION CIRCUIT



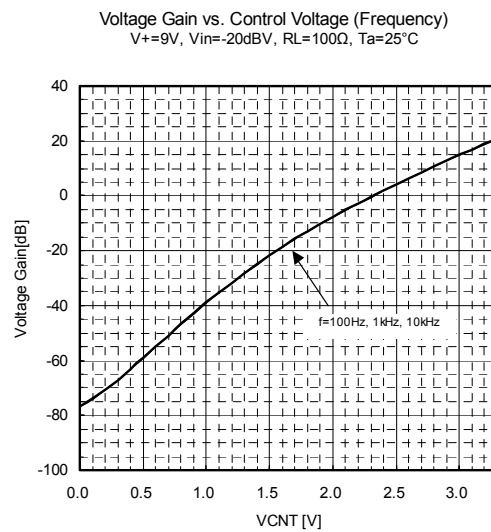
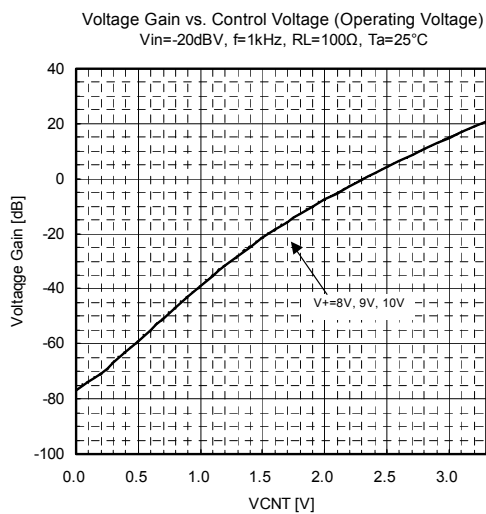
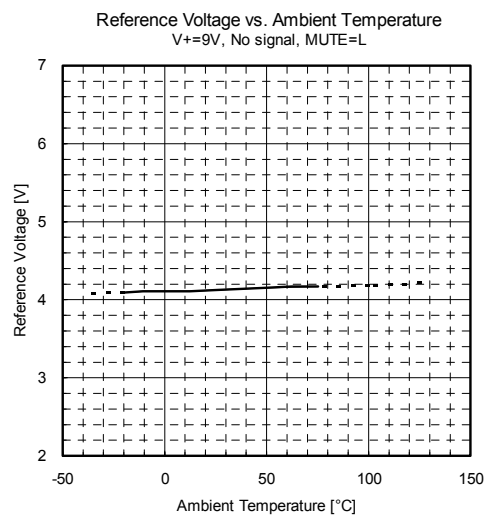
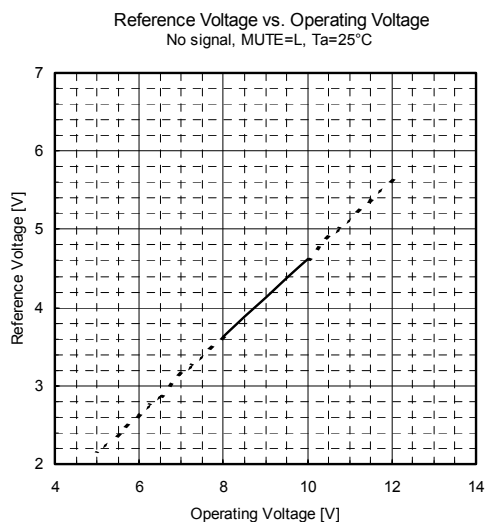
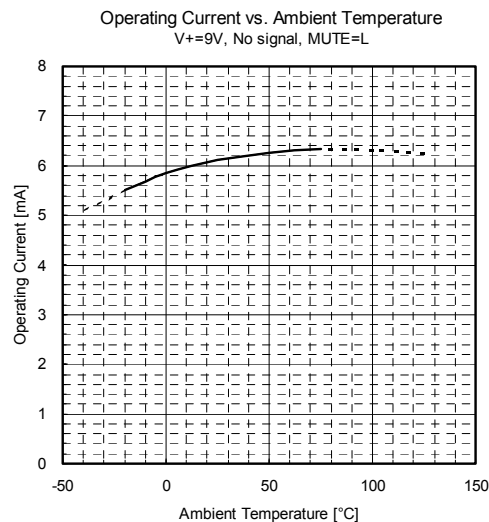
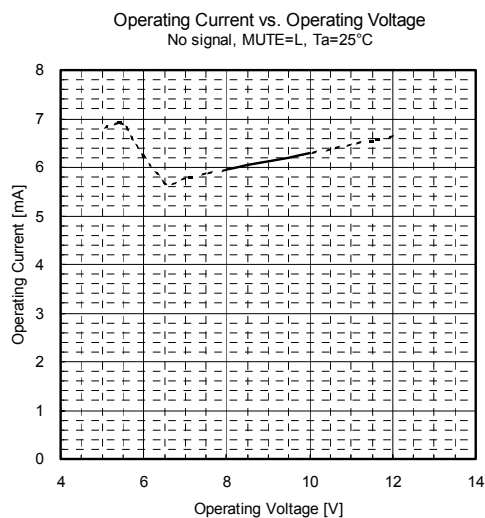
■ TERMINAL DESCRIPTION

| PIN NO. | SYMBOL       | FUNCTION                                                                                                                                   | EQUIVALENT CIRCUIT                                                                   | TERMINAL VOLTAGE |
|---------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------|
| 2<br>13 | OUTb<br>OUTa | Bch Output<br>Ach Output                                                                                                                   |    | V+/2             |
| 3<br>12 | CNTb<br>CNTa | Bch Volume Control<br>Ach Volume Control                                                                                                   |   | -                |
| 4<br>11 | CAPb<br>CAPa | Bch Volume control click noise absorbing capacitor connect terminal<br>Ach Volume control click noise absorbing capacitor connect terminal |  | -                |
| 5<br>10 | INb<br>INa   | Bch Input<br>Ach Input                                                                                                                     |  | GND              |

## ■ TERMINAL DESCRIPTION

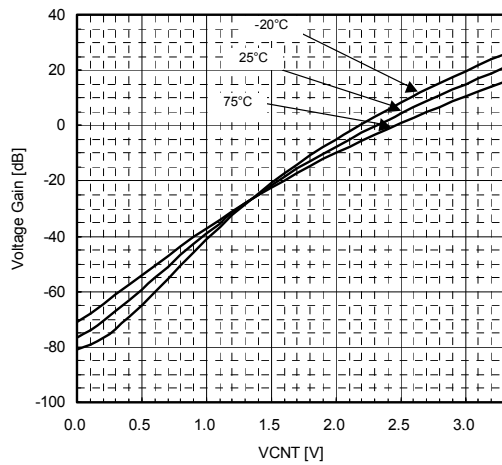
| PIN NO. | SYMBOL | FUNCTION                                                | EQUIVALENT CIRCUIT | TERMINAL VOLTAGE |
|---------|--------|---------------------------------------------------------|--------------------|------------------|
| 6       | Mute   | Mute Control                                            |                    | GND              |
| 9       | Vref   | Reference voltage stabilized capacitor connect terminal |                    | V+/2             |

■ TYPICAL CHARACTERISTICS

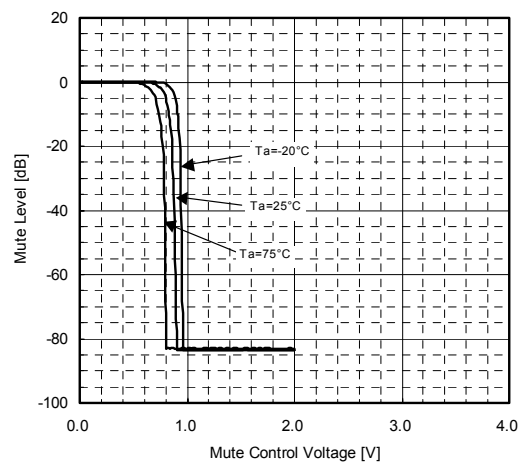


## TYPICAL CHARACTERISTICS

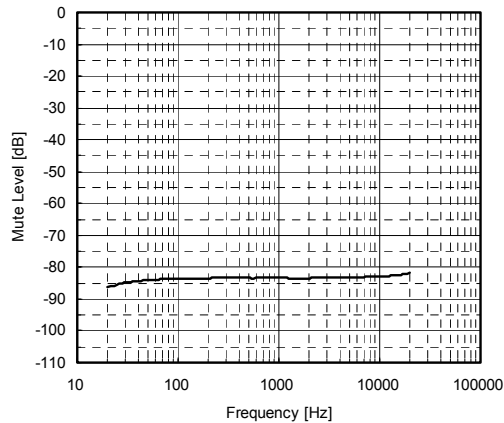
Voltage Gain vs. Control Voltage (Ambient Temperature)  
 $V_+ = 9V$ ,  $V_{in} = -20dBV$ ,  $f = 1kHz$ ,  $R_L = 100\Omega$



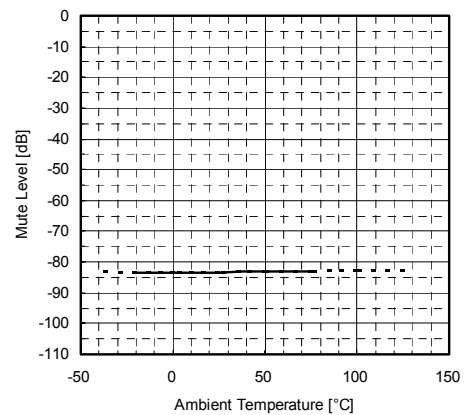
Mute Level vs. Mute Control Voltage  
 $V_+ = 9V$ ,  $V_{in} = 0dBV$ ,  $f = 1kHz$ ,  $G_v = 0dB$ ,  $R_L = 100\Omega$



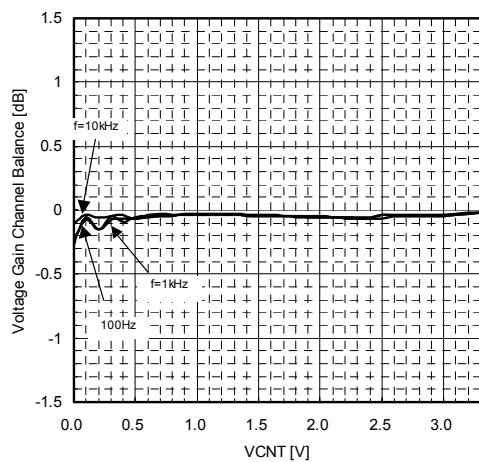
Mute Level vs. Frequency  
 $V_+ = 9V$ ,  $V_{in} = 0dBV$ ,  $G_v = 0dB$ ,  $R_L = 100\Omega$ , MUTE=H,  $T_a = 25^\circ C$



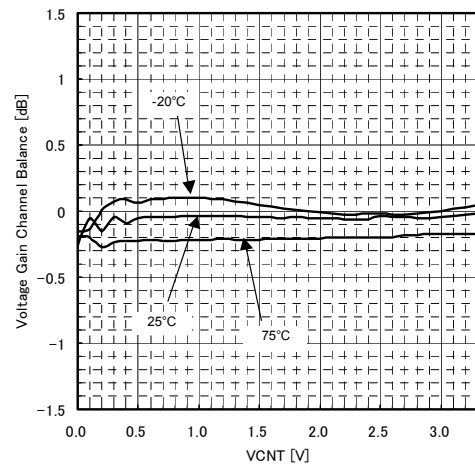
Mute Level vs. Ambient Temperature  
 $V_+ = 9V$ ,  $V_{in} = 0dBV$ ,  $f = 1kHz$ ,  $G_v = 0dB$ ,  $R_L = 100\Omega$ , MUTE=H



Voltage Gain Channel Balance vs. Control Voltage (Frequency)  
 $V_+ = 9V$ ,  $V_{in} = -20dBV$ ,  $R_L = 100\Omega$ ,  $T_a = 25^\circ C$

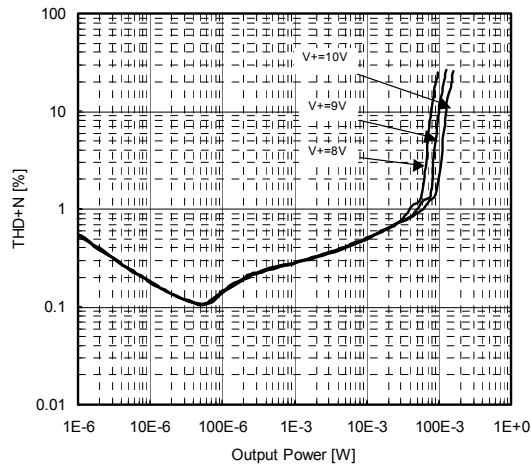


Voltage Gain Channel Balance vs. Control Voltage (Ambient Temperature)  
 $V_+ = 9V$ ,  $V_{in} = -20dBV$ ,  $f = 1kHz$ ,  $R_L = 100\Omega$

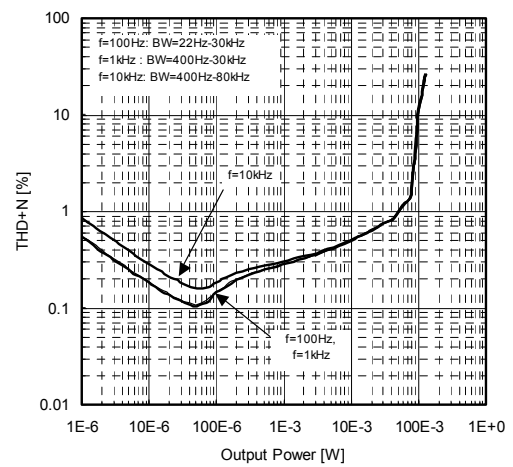


## TYPICAL CHARACTERISTICS

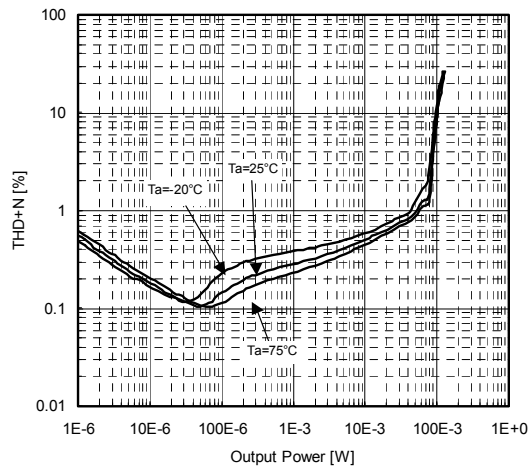
THD+N vs. Output Power (Operating Voltage)  
 $f=1\text{kHz}$ ,  $G_v=10\text{dB}$ ,  $R_L=100\Omega$ ,  $BW=400\text{Hz}-30\text{kHz}$ ,  $T_a=25^\circ\text{C}$



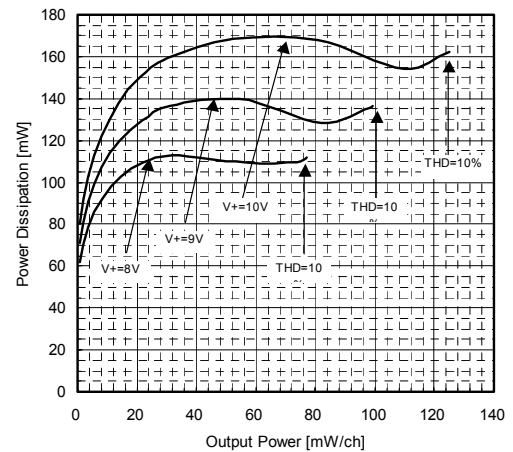
THD+N vs. Output Power (Frequency)  
 $V_+=9\text{V}$ ,  $G_v=10\text{dB}$ ,  $R_L=100\Omega$ ,  $T_a=25^\circ\text{C}$



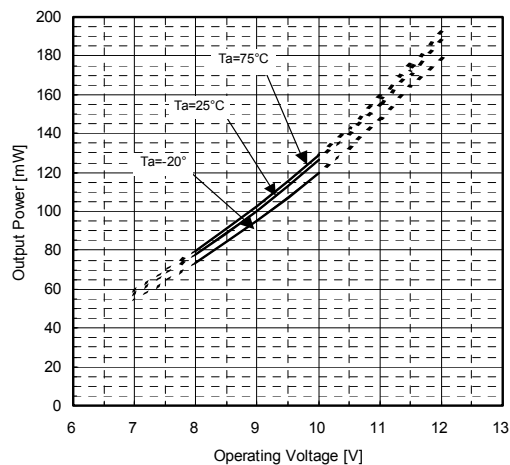
THD+N vs. Output Power (Ambient Temperature)  
 $V_+=9\text{V}$ ,  $f=1\text{kHz}$ ,  $G_v=10\text{dB}$ ,  $R_L=100\Omega$ ,  $BW=400\text{Hz}-30\text{kHz}$



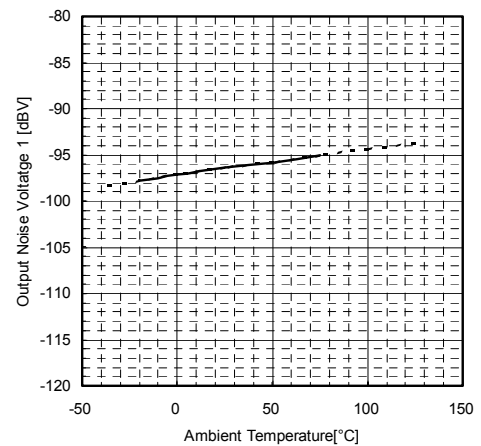
Power Dissipation vs. Output Power  
 $f=1\text{kHz}$ ,  $G_v=10\text{dB}$ ,  $R_L=100\Omega$ ,  $BW=400\text{Hz}-30\text{kHz}$ ,  $T_a=25^\circ\text{C}$ , 2ch Input



Output Power vs. Operating Voltage  
 $f=1\text{kHz}$ ,  $\text{THD}=10\%$ ,  $G_v=10\text{dB}$ ,  $R_L=100\Omega$ ,  $BW=400\text{Hz}-30\text{kHz}$

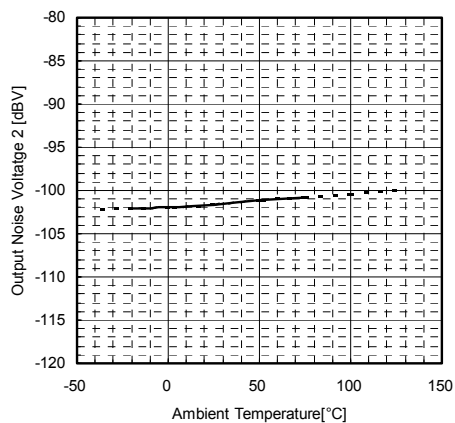


Output Noise Voltage 1 vs. Ambient Temperature  
 $V_+=9\text{V}$ ,  $G_v=0\text{dB}$ ,  $R_L=100\Omega$ ,  $R_g=0\Omega$ , A-Weighted, MUTE=L



## ■ TYPICAL CHARACTERISTICS

Output Noise Voltage 2 vs. Ambient Temperature  
 $V_{+}=9V$ ,  $R_L=100\Omega$ ,  $R_g=0\Omega$ , A-Weighted, MUTE=H



### [CAUTION]

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