# High Quality Audio J-FET Input Dual Operational Amplifier

## ■ GENERAL DESCRIPTION

The MUSES8920 is a high quality audio J-FET input dual operational amplifier, which is optimized for high-end audio, professional audio and portable audio applications.

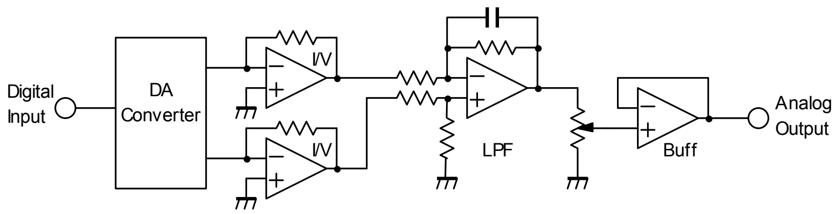
It is suitable for audio preamplifiers, active filters, and line amplifiers. In addition, J-FET input type has advantage of the low input bias current, it is suitable for transimpedance amplifier (I/V converter).

## ■ FEATURES

| | |
|---|---|
| ●Operating Voltage | ±3.5V to ±17V |
| ●Low Noise | 8nV/√Hz typ. |
| ●THD | 0.0004% typ. (Av=1) |
| ●Slew Rate | 25V/µs typ. |
| ●GBW | 11MHz typ. |
| ●High Output Current | 100mA typ.(short-circuit current) |
| ●J-FET Input | |
| ●Bipolar Technology | |
| ●Package Outline | DIP8, SOP8 JEDEC 150mil<br>DFN8-X7 (ESON8-X7)(3.5mm x 4.0mm) |

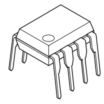
## ■ APPLICATIONS

- Portable Audio
- Home Audio
- Professional Audio
- Car Audio

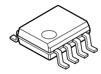



DAC Output I/V converter + LPF circuit

## ■ PACKAGE OUTLINE



MUSES8920D
(DIP8)

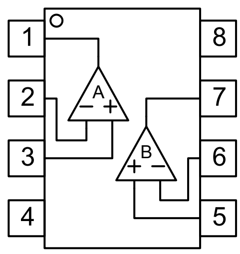


MUSES8920E
(SOP8 JEDEC 150mil (EMP8))

MUSES8920KX7
(DFN8-X7 (ESON8-X7))

## ■ PIN CONFIGLATION

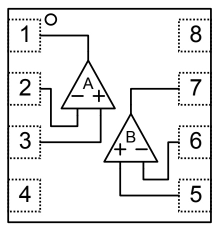
DIP8, SOP8 JEDEC 150mil



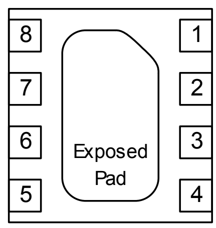

1. A OUTPUT
2. A -INPUT
3. A +INPUT
4. V-
5. B +INPUT
6. B -INPUT
7. B OUTPUT
8.V+

DFN8-X7 (ESON8-X7)

Top View




Bottom View




About Exposed Pad

Connect the Exposed Pad on the GND.

## ■ ABSOLUTE MAXIMUM RATING (Ta=25ºC unless otherwise specified)

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage | $V^+/V^-$ | ±18 | V |
| Differential Input Voltage Range | $V_{ID}$ | ±30 | V |
| Common Mode Input Voltage Range | $V_{ICM}$ | ±15 (Note1) | V |
| Power Dissipation | $P_D$ | DIP8:870<br>SOP8:900 (Note2)<br>DFN8-X7: 690 (Note2)<br>2900 (Note3) | mW |
| Operating Temperature Range | Topr | -40 to +125 | ºC |
| Storage Temperature Range | Tstg | -50 to +150 | ºC |

(Note1) For supply Voltages less than ±15 V, the maximum input voltage is equal to the Supply Voltage.
(Note2) Mounted on the EIA/JEDEC standard board (114.3×76.2×1.6mm, two layer, FR-4). DFN8 is connecting to GND in the center part on the back.
(Note3) EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 4layers, FR-4, Applying a thermal via hole to a board based on JEDEC standard JESD51-5) mounting. The PAD connecting to GND in the center part on the back.
(Note4) NJM8920 is ESD (electrostatic discharge) sensitive device.
Therefore, proper ESD precautions are recommended to avoid permanent damage or loss of functionality.

## ■ RECOMMENDED OPERATING VOLTAGE (Ta=25ºC)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Supply Voltage | $V^+/V^-$ | | ±3.5 | - | ±17 | V |

## ■ ELECTRICAL CHARACTERISTICS

### ● DC CHARACTERISTICS ($V^+/V^-$=±15V, Ta=25ºC, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Supply Current | Icc | RL=∞, No Signal | - | 9 | 12 | mA |
| Input Offset Voltage | $V_{IO}$ | $R_S$=50Ω, | - | 0.8 | 5 | mV |
| Input Bias Current | $I_B$ | | - | 5 | 250 | pA |
| Input Offset Current | $I_{IO}$ | | - | 2 | 220 | pA |
| Voltage Gain1 | $A_{V1}$ | $R_L$=10kΩ, Vo=±13V | 106 | 135 | - | dB |
| Voltage Gain2 | $A_{V2}$ | $R_L$=2kΩ, Vo=±12.8V | 105 | 133 | - | dB |
| Voltage Gain3 | $A_{V3}$ | $R_L$=600Ω, Vo=12.5V | 105 | 130 | - | dB |
| Common Mode Rejection Ratio | CMR | $V_{ICM}$=±12.5V (Note5) | 80 | 110 | - | dB |
| Supply Voltage Rejection Ratio | SVR | $V^+/V^-$=±3.5 to ±17V (Note6) | 80 | 110 | - | dB |
| Maximum Output Voltage1 | $V_{OM1}$ | $R_L$=10kΩ | ±13 | ±14 | - | V |
| Maximum Output Voltage2 | $V_{OM2}$ | $R_L$=2kΩ | ±12.8 | ±13.8 | - | V |
| Maximum Output Voltage3 | $V_{OM3}$ | $R_L$=600Ω | ±12.5 | ±13.5 | - | V |
| Common Mode Input Voltage Range | $V_{ICM}$ | CMR≥80dB | ±12.5 | ±14 | - | V |

(Note5) CMR is calculated by specified change in offset voltage. ($V_{ICM}$=0V to +12.5V, $V_{ICM}$=0V to -12.5V)
(Note6) SVR is calculated by specified change in offset voltage. ($V^+/V^-$=±3.5 to ±17V)

### ● AC CHARACTERISTICS ($V^+/V^-$=±15V, Ta=25ºC, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Gain Bandwidth Product | GB | f=10kHz | - | 11 | - | MHz |
| Unity Gain Frequency | $f_T$ | $A_V$=+100, $R_S$=100Ω, $R_L$=2kΩ, $C_L$=10pF | - | 10 | - | MHz |
| Phase Margin | $\Phi_M$ | $A_V$=+100, $R_S$=100Ω, $R_L$=2kΩ, $C_L$=10pF | - | 70 | - | Deg |
| Equivalent Input Noise Voltage1 | $V_{NI1}$ | f=1kHz | - | 8 | - | nV/√Hz |
| Equivalent Input Noise Voltage2 | $V_{NI2}$ | RIAA, $R_S$=2.2kΩ, 30kHz, LPF (Note7) | - | 1.1 | 3.5 | μVrms |
| Equivalent Input Noise Voltage3 | $V_{NI3}$ | f=20 to 20kHz (Note8) | - | 1.1 | - | μVrms |
| Total Harmonic Distortion | THD | f=1kHz , $A_V$=+10, Vo=5Vrms, $R_L$=2kΩ | - | 0.0004 | - | % |
| Channel Separation | CS | f=1kHz , $A_V$=-100, $R_L$=2kΩ | - | 150 | - | dB |
| Slew Rate | SR | $A_V$=1, $V_{IN}$=2Vp-p, $R_L$=2kΩ, $C_L$=10pF | - | 25 | - | V/us |

(Note7) DIP8 and SOP8
(Note8) DFN8-X7

## ■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

IC is heated by own operation and possibly gets damage when the junction power exceeds the acceptable value called Power Dissipation $P_D$. The dependence of the MUSES8920 $P_D$ on ambient temperature is shown in Fig 1. The plots are depended on following two points. The first is $P_D$ on ambient temperature 25ºC, which is the maximum power dissipation. The second is 0W, which means that the IC cannot radiate any more. Conforming the maximum junction temperature Tjmax to the storage temperature Tstg derives this point. Fig.1 is drawn by connecting those points and conforming the $P_D$ lower than 25ºC to it on 25ºC. The $P_D$ is shown following formula as a function of the ambient temperature between those points.

$$\text{Dissipation Power}\quad P_D = \frac{Tjmax - Ta}{\theta ja}\ \text{[W] (Ta=25ºC to Ta=150ºC)}$$

Where, $\theta$ja is heat thermal resistance which depends on parameters such as package material, frame material and so on. Therefore, $P_D$ is different in each package.

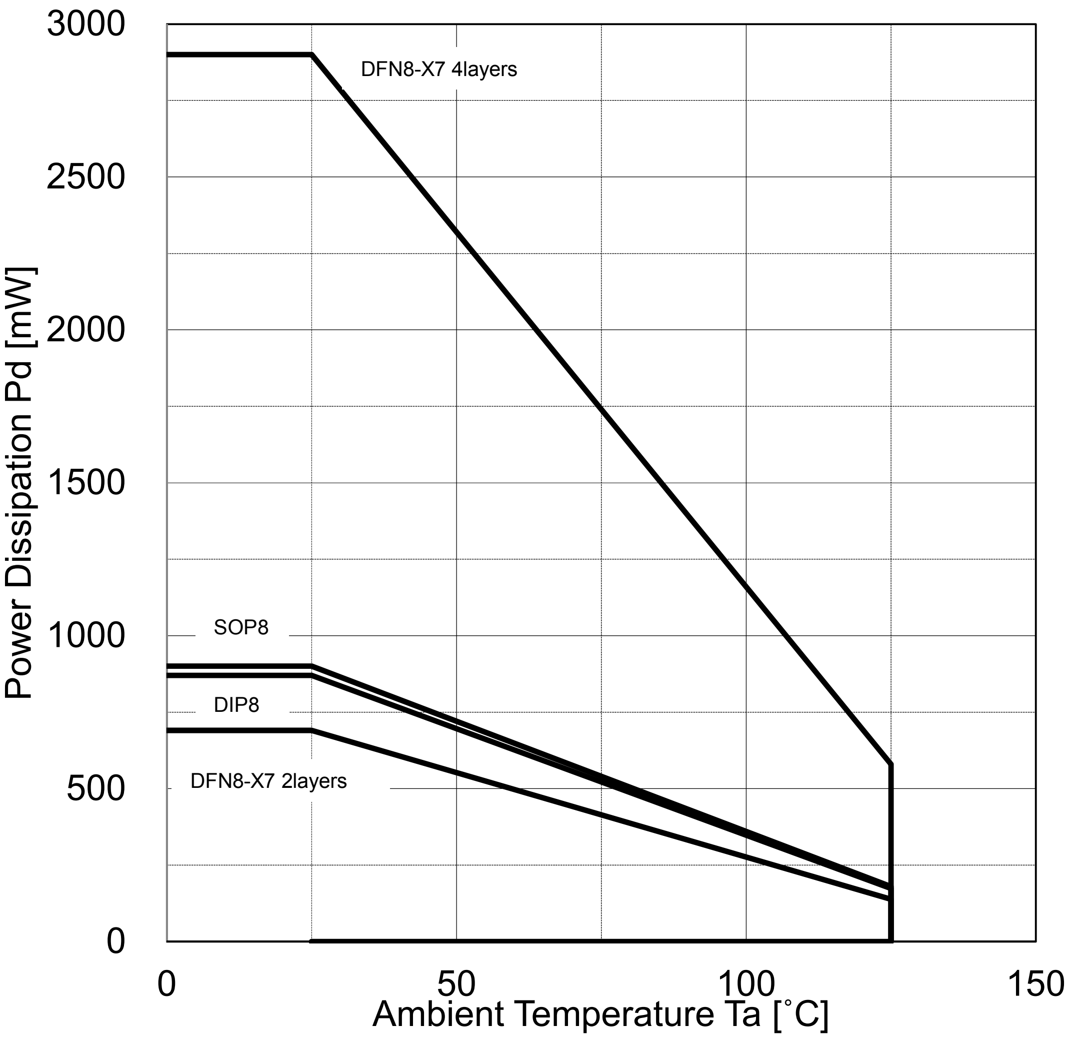
While, the actual measurement of dissipation power on MUSES8920 is obtained using following equation.

(Actual Dissipation Power) = (Supply Current Icc) X (Supply Voltage $V^+$– V-) – (Output Power Po)

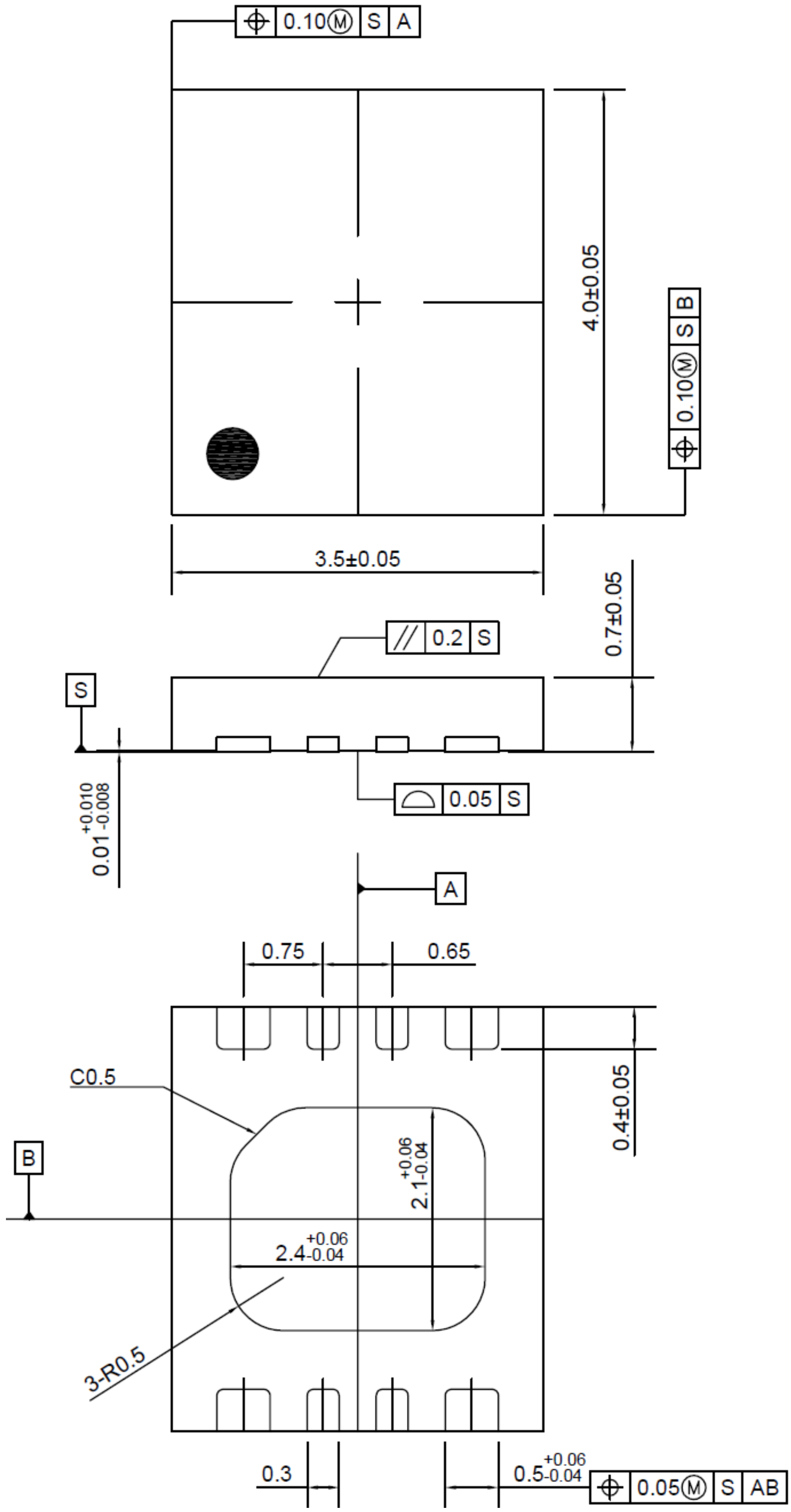
The MUSES8920 should be operated in lower than $P_D$ of the actual dissipation power.

To sustain the steady state operation, take account of the Dissipation Power and thermal design.

Fig 1

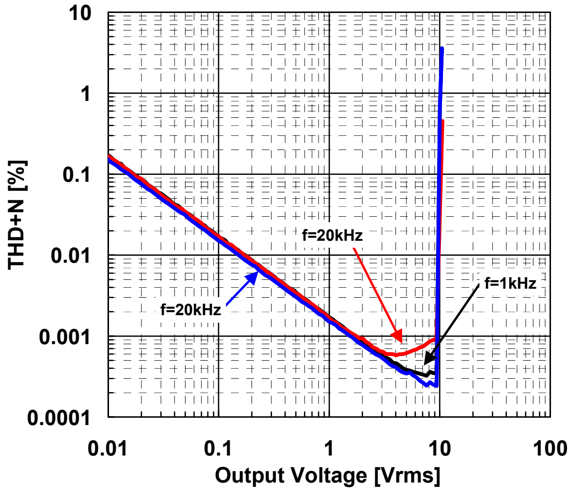


■ PACKAGE OUTLINE (DFN8-X7)

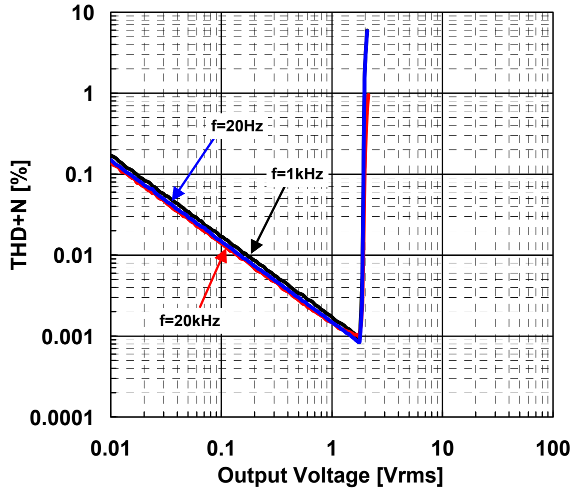


## ■ TYPICAL CARACTERISTICS

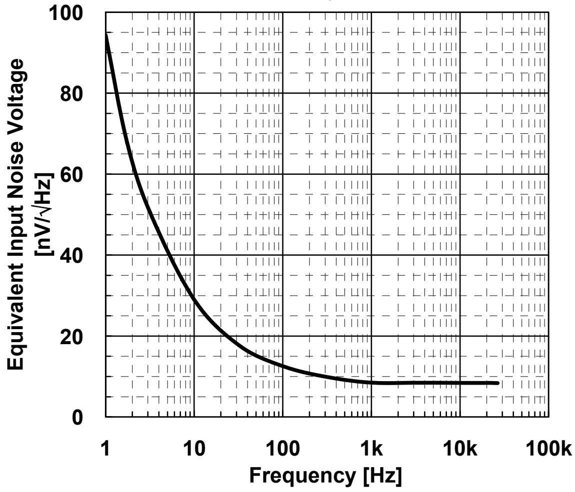
**THD+N vs. Output Voltage (Frequency)**
$V^+/V^-$=±15V, $A_V$=+10, $R_L$=2k, Ta=25ºC



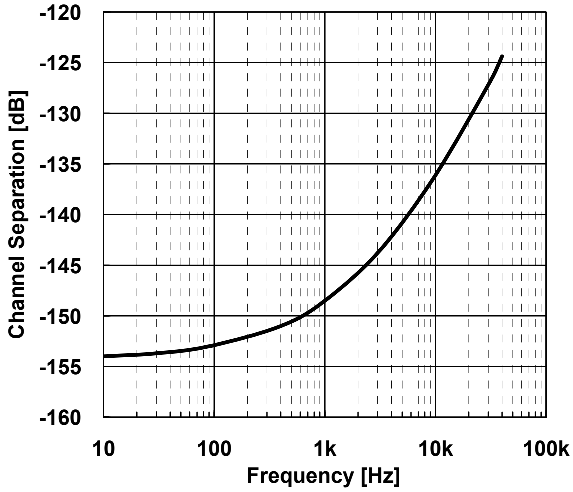

**THD+N vs. Output Voltage (Frequency)**
$V^+/V^-$=±3.5V, $A_V$=+10, $R_L$=2k, Ta=25ºC



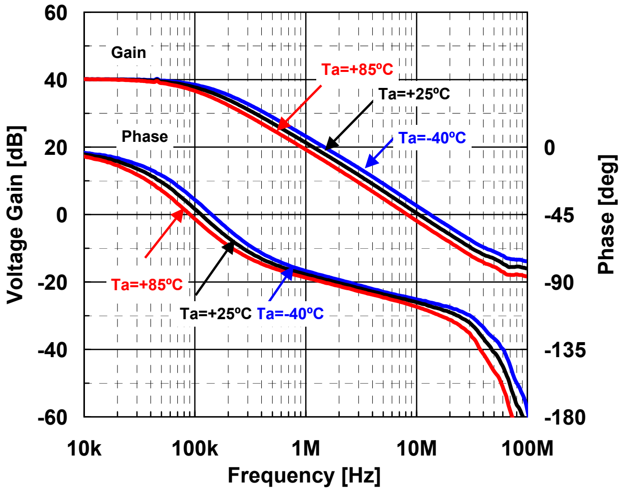

**Voltage Noise vs. Frequency**
$V^+/V^-$=±15V, $A_V$=+100, $R_S$=100Ω, $R_L$=∞, Ta=25ºC



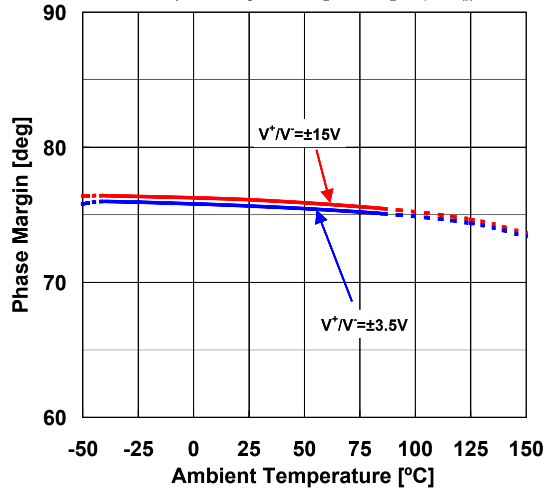

**Channel Separation vs. Frequency**
$V^+/V^-$=±15V, $A_V$=-100, $R_L$=2kΩ, Ta=25ºC




**Gain vs. Frequency (Temperature)**
$V^+/V^-$=±15V, $A_V$=+100, $R_L$=2kΩ, $C_L$=10pF

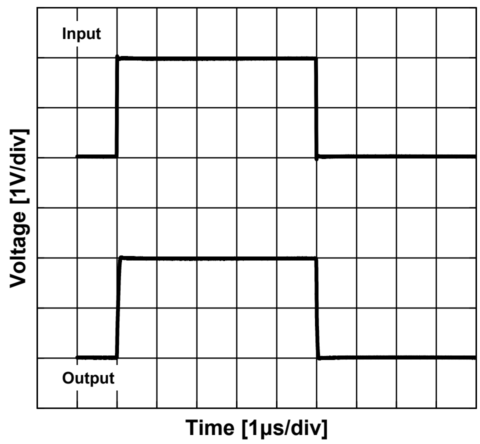



**Phase Margin vs. Temperature (Supply Voltage)**
$V^+/V^-$=±15V, $A_V$=+100, $R_S$=100Ω, $R_L$=2kΩ, $C_L$=10pF, $V_{IN}$=-30dBm

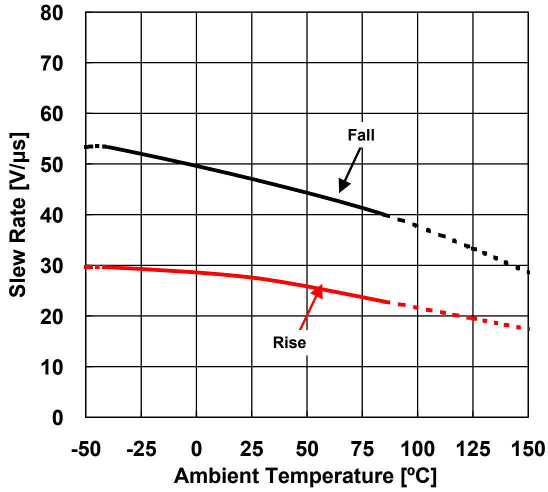


## ■ TYPICAL CARACTERISTICS

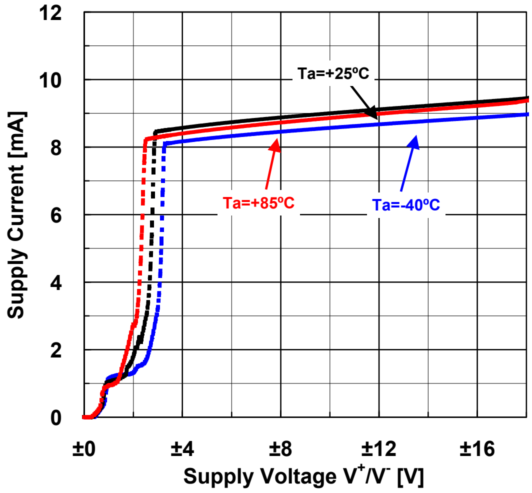
**Pulse Response**
$V^+/V^-$=±15V, Gv=0dB, $C_L$=10pF, $R_L$=2kΩ, Ta=25ºC



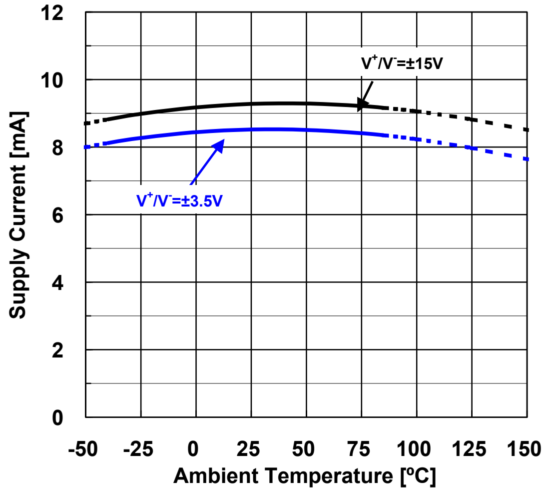

**Slew Rate vs. Temperature**
$V^+/V^-$=±15V, $V_{IN}$=2$V_{P-P}$, f=100kHz, Gv=0dB, $C_L$=10pF, $R_L$=2kΩ



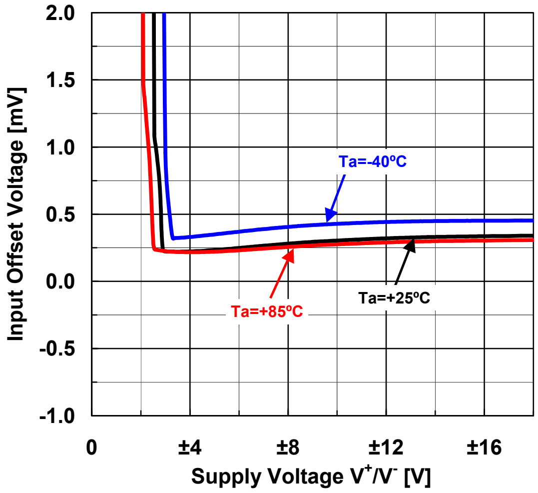

**Supply Current vs. Supply Voltage** (Temperature)
$A_V$=0dB



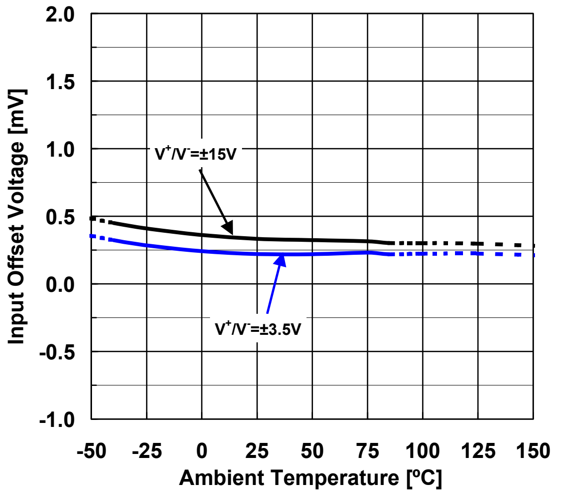

**Supply Current vs. Temperature** (Supply Voltage)
$A_V$=0dB



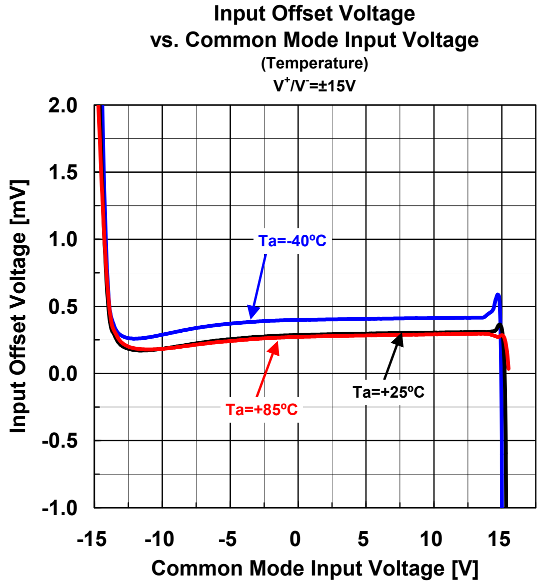

**Input Offset Voltage vs. Supply Voltage** (Temperature)
$V_{ICM}$=0V, $V_{IN}$=0V

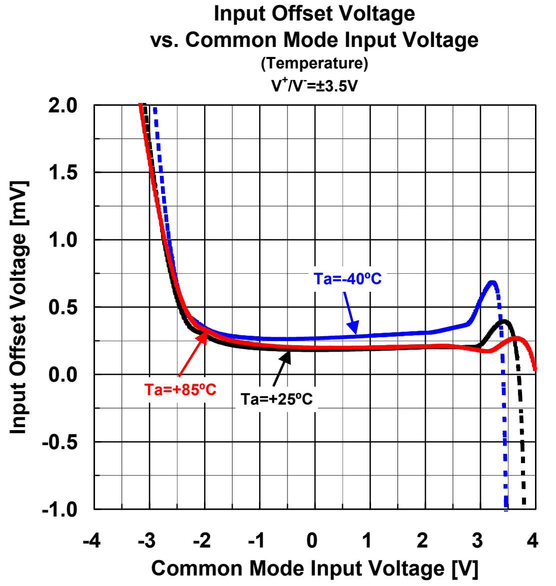


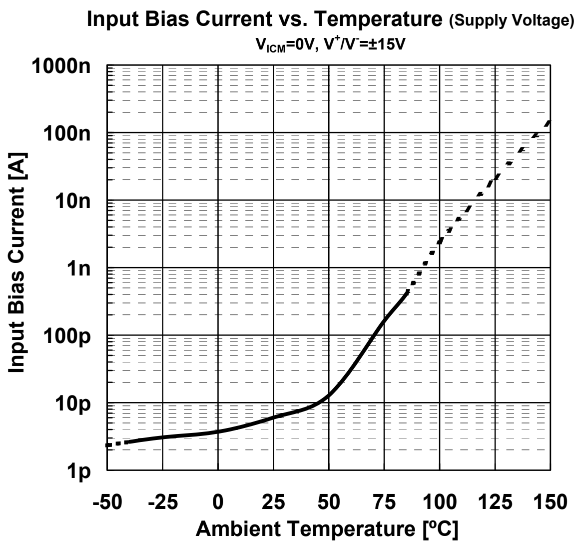

**Input Offset Voltage vs. Temperature** (Supply Voltage)
$V_{ICM}$=0V, $V_{IN}$=0V

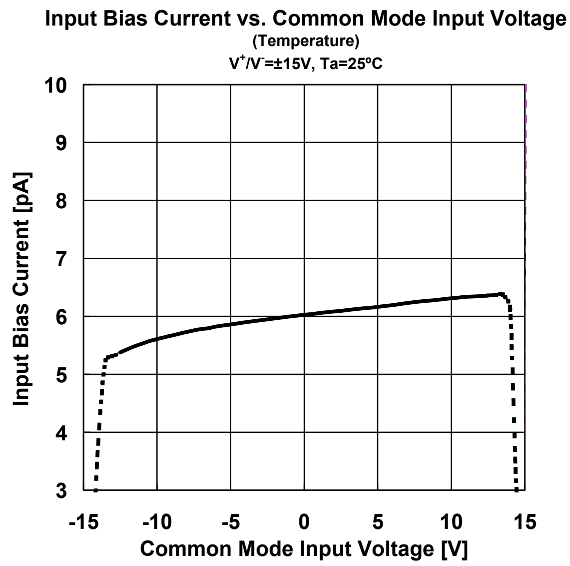


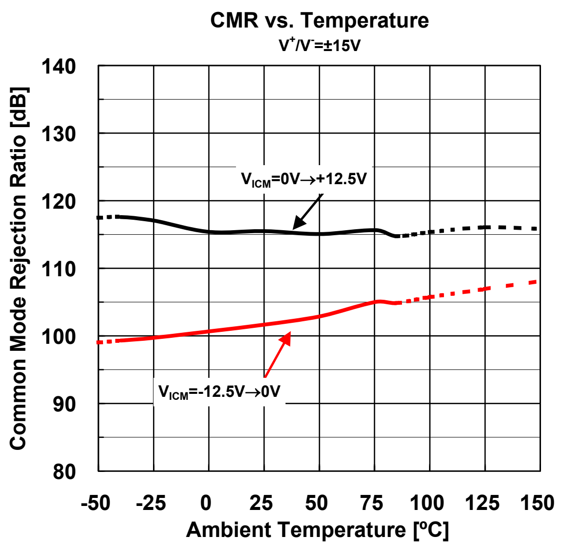
## ■ TYPICAL CARACTERISTICS

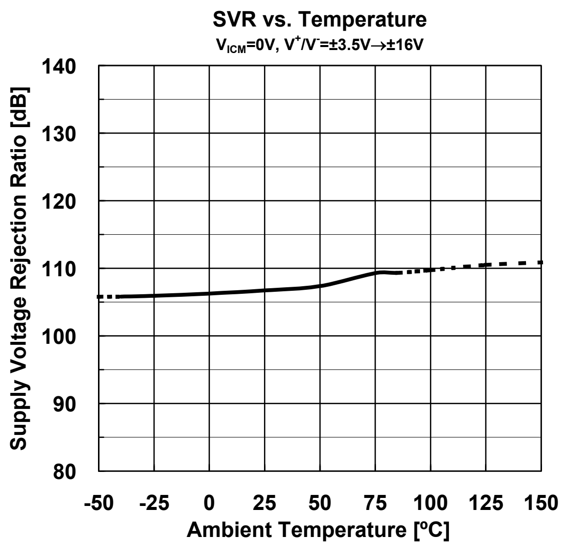


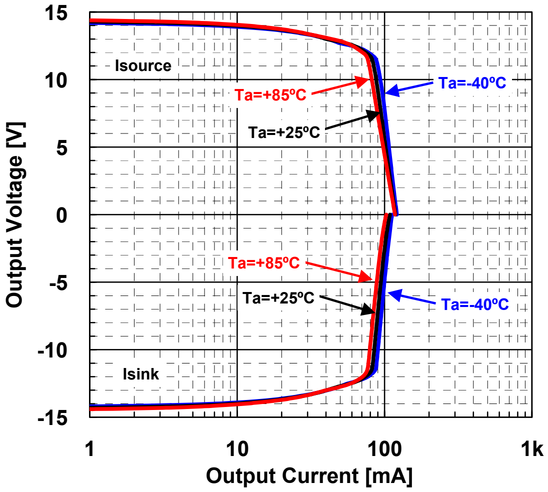



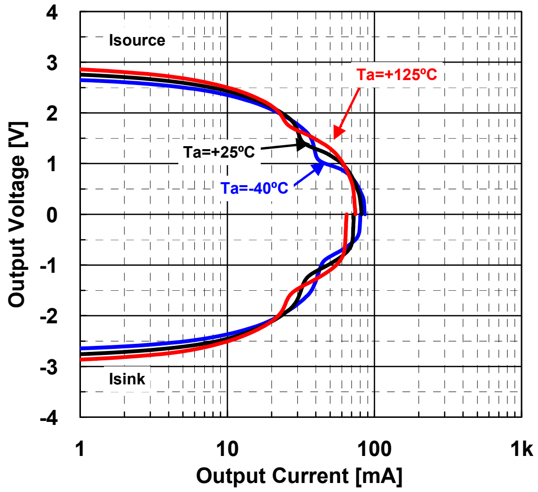



## ■ TYPICAL CARACTERISTICS

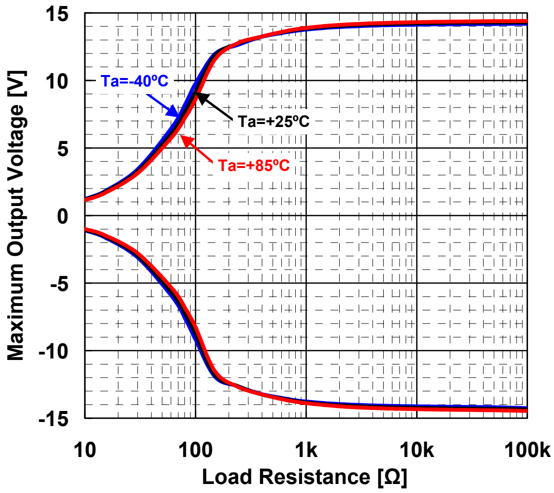
**Output Voltage vs. Output Current** (Temperature)
$V^+/V^-=\pm15V$



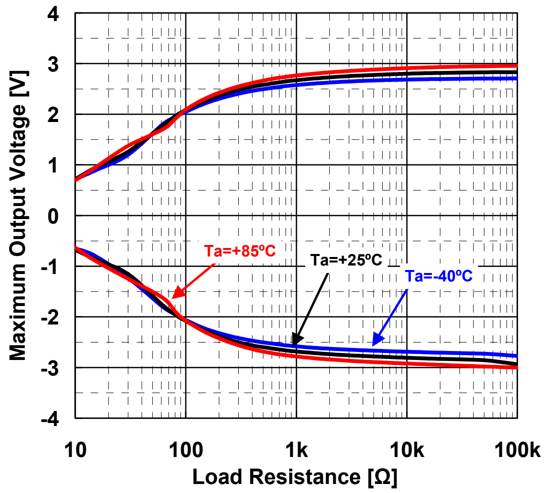

**Output Voltage vs. Output Current** (Temperature)
$V^+/V^-=\pm3.5V$



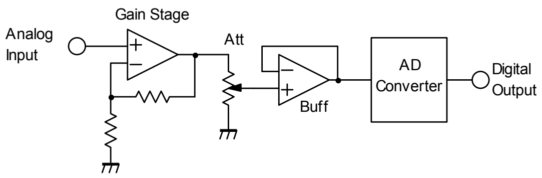

**Maximum Output Voltage vs. Load Resistance**
(Temperature)
$V^+/V^-=\pm15V$, Gv=open, $R_L$ to 0V



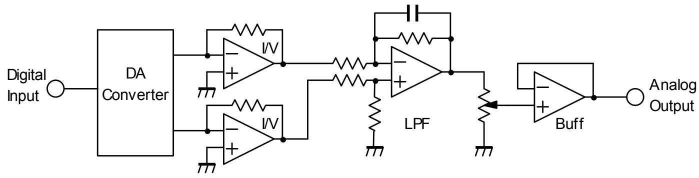

**Maximum Output Voltage vs. Load Resistance**
(Temperature)
$V^+/V^-=\pm3.5V$, Gv=open, $R_L$ to 0V



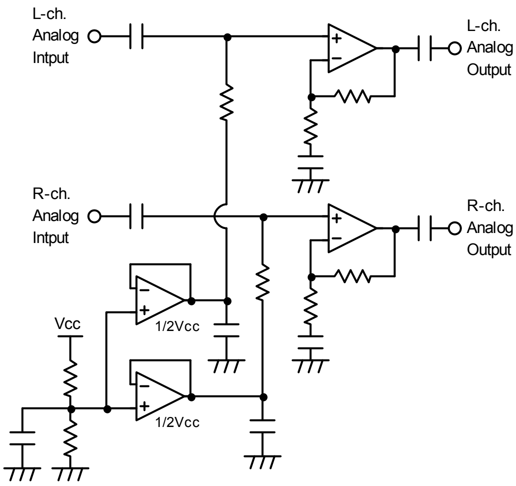
## ■ APPLICATION CIRCUIT



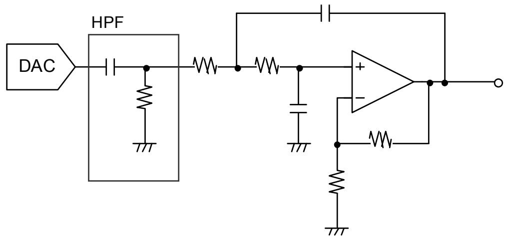

(Fig.1: ADC Input)




(Fig.2:DAC Output)




(Fig.3: Half Vcc Buffer on Single Supply Application)




(Fig.4:DAC LPF Circuit )

## ■ NOTE
**Precaution for counterfeit semiconductor products**

We have recently detected many counterfeit semiconductor products that have very similar appearances to our operational amplifier “MUSES” in the world-wide market.In most cases, it is hard to distinguish them from our regular products by their appearance, and some of them have very poor quality and performance.
They can not provide equivalent quality of our regular product, and they may cause breakdowns or malfunctions if used in your systems or applications.

We would like our customers to purchase “MUSES” through our official sales channels : our sales branches, sales subsidiaries and distributors.

Please note that we hold no responsibilities for any malfunctions or damages caused by using counterfeit products. We would appreciate your understanding.

Стандарт
Электрон
Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** sales@st-electron.ru

**Адрес:** 198099, Санкт-Петербург, Промышленная ул, дом № 19, литера Н, помещение 100-Н Офис 331