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New Japan Radio Co.,Ltd.

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# High Quality Audio
# J-FET Input Dual Operational Amplifier

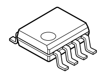
## ■GENERAL DESCRIPTION

The NJM8901 is a high quality audio dual operational Amplifier with JFET technology, strikes a balance between “MUSES technology” and mass-production technique.

The original process tuning and the assembly technology, based on MUSES technology, make excellent sound and absorbing cost increases.

The characteristics like Low noise (13nV/√Hz), high slew rate (20V/µs) and low distortion (0.003% at Av=10) suitable for audio preamplifiers, active filters, and line amplifiers. In addition, taking advantage of the low input bias current that J-FET has, it is suitable for transimpedance amplifier (I/V converter).

## ■PACKAGE OUTLINE



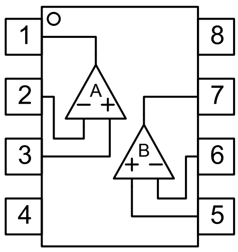
**(SOP8 JEDEC 150 mil)**

## ■FEATURES

| | |
|---|---|
| ●Low Noise | 13nV/√Hz typ. |
| | 1.6uVrms typ. (RIAA) |
| ●Low Distortion | 0.003% typ. (Av=10) |
| ●Wide Gain Bandwidth Product | 5MHz typ. |
| ●Slew Rate | 20V/µs typ. |
| ●Input Offset Voltage | 2mV typ. 10mV max. |
| ●Input Bias Current | 30pA typ. 400pA max. |
| ●Open Loop Voltage Gain | 110dB typ. |
| ●Operating Voltage | ±4V ~±18V |
| ●J-FET Technology | |
| ●Package Outline | SOP8 JEDEC 150 mil |

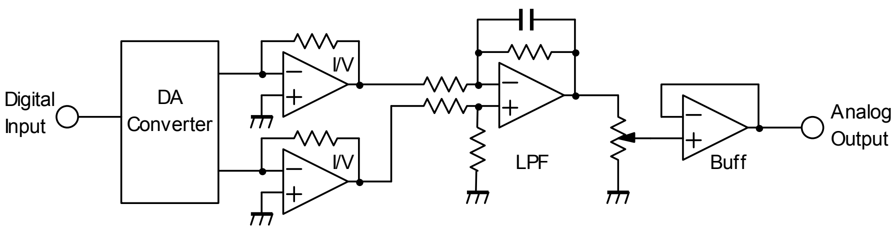
## ■ PIN CONFIGLATION

**(Top View)**




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

## ■TYPICAL APPLICATION




DAC Output I/V converter + LPF circuit

## ■ABSOLUTE MAXIMUM RATINGS (Ta=25ºC)

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage | $V^+/V^-$ | ±18 | V |
| Common Mode Input Voltage Range | $V_{ICM}$ | ±15 (Note1) | V |
| Differential Input Voltage Range | $V_{ID}$ | ±30 | V |
| Power Dissipation | $P_D$ | 550 (Note2) | mW |
| Operating Temperature Range | $T_{OPR}$ | -40~+85 | ºC |
| Storage Temperature Range | $T_{STG}$ | -40~+125 | ºC |

(Note 1) For supply Voltages less than ±15V, the maximum input voltage is equal to the Supply Voltage.
(Note 2) Mounted on the EIA/JEDEC standard board (114.3×76.2×1.6mm, two layer, FR-4).
Please refer to the following Power Dissipation and Ambient Temperature.

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

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Supply Voltage | $V^+/V^-$ | | ±4.0 | - | ±18 | V |

## ■ELECTRIC CHARACTERISTICS

### ●DC CHARACTERISTICS ($V^+/V^-$=±15V, Vcm=0V, Ta=25ºC, unless otherwise noted.)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Supply Current | $I_{CC}$ | $R_L$=∞, No Signal | - | 4 | 6 | mA |
| Input Offset Voltage | $V_{IO}$ | $R_S$=50Ω (Note3) | - | 2 | 10 | mV |
| Input Bias Current | $I_B$ | | - | 30 | 400 | pA |
| Input Offset Current | $I_{IO}$ | (Note3) | - | 5 | 200 | pA |
| Input Resistance | $R_{IN}$ | | - | $10^{12}$ | - | Ω |
| Large Signal Voltage Gain | $A_V$ | $R_L$≥2kΩ, Vo=±10V | 86 | 110 | - | dB |
| Common Mode Rejection Ratio | CMR | $V_{CM}$=±12V, Rs≤10kΩ | 70 | 90 | - | dB |
| Supply Voltage Rejection Ratio | SVR | $V^+/V^-$=±9.0 to ±18V, Rs≤10kΩ | 76 | 100 | - | dB |
| Maximum Output Voltage | $V_{OM}$ | $R_L$≥10kΩ | ±12 | +13.5, -13 | - | V |
| Common Mode Input Voltage Range | $V_{ICM}$ | CMR≥70dB | ±12 | +15, -12.5 | - | V |

(Note3) Written by the absolute rate.

### ●AC CHARACTERISTICS ($V^+/V^-$=±15V, Vcm=0V, Ta=25ºC unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Slew Rate | SR | $R_L$≥2kΩ | - | 20 | - | V/us |
| Gain Bandwidth Product | GB | f=10kHz | - | 5 | - | MHz |
| Equivalent Input Noise Voltage1 | $e_N$ | $R_S$=100Ω , f=1KHz | - | 13 | - | nV/√Hz |
| Equivalent Input Noise Voltage2 | $V_{NI}$ | RIAA, $R_S$=2.2kΩ, 30kHz, LPF | - | 1.6 | 3 | μVrms |
| Total Harmonic Distortion | THD | f=1kHz ,$A_V$=+10, Vo=5Vrms, $R_L$=2kΩ | - | 0.003 | - | % |
| Channel Separation | CS | f=1kHz , $A_V$=-100, $R_S$=1kΩ, $R_L$=2kΩ | | 130 | - | dB |

## ■Application Notes

### ●Package Power, Power Dissipation and Output Power

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 $P_D$ 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, θja 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 IC is obtained using following equation.

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

This IC 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.

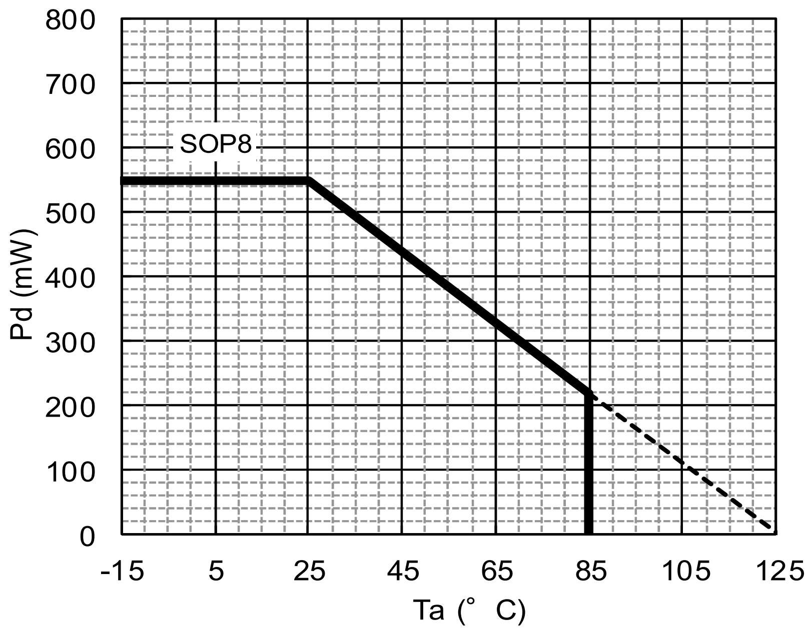
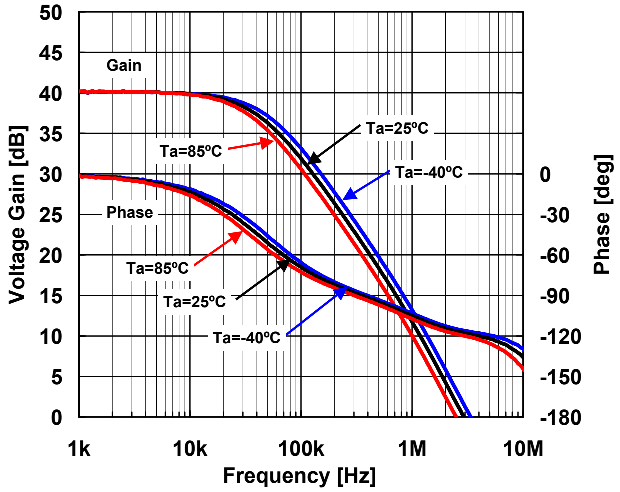


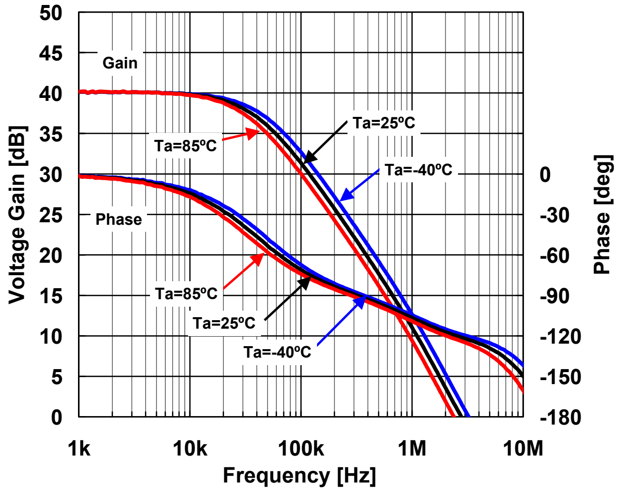

**Fig.1 Power Dissipations vs. Ambient Temperature**

## ■ TYPICAL CHARACTERISTICS

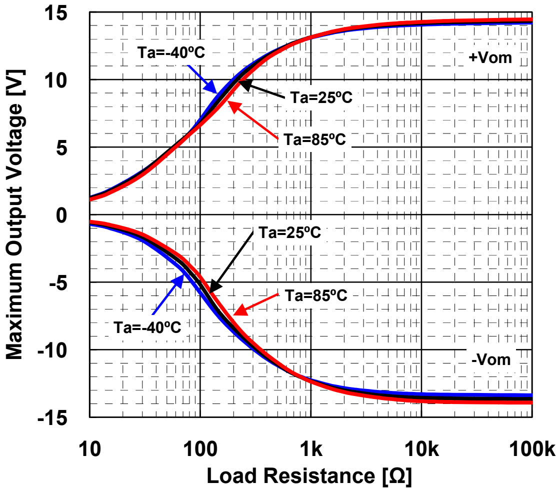
**Gain vs. Frequency** (Temperature)
$V^+/V^-$=±15V, $A_V$=+100, $R_L$=2kΩ, $C_L$=10pF



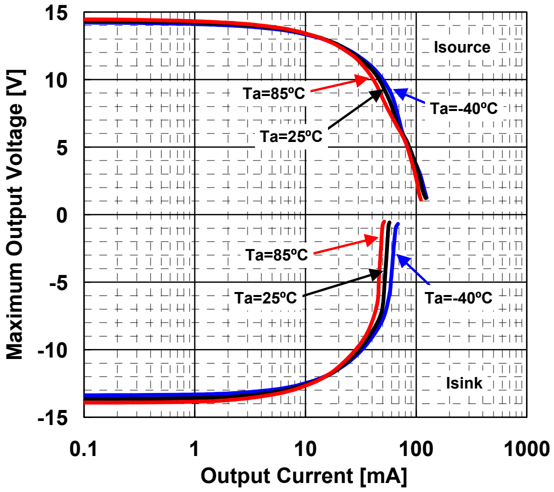

**Gain vs. Frequency** (Temperature)
$V^+/V^-$=±4V, $A_V$=+100, $R_L$=2kΩ, $C_L$=10pF



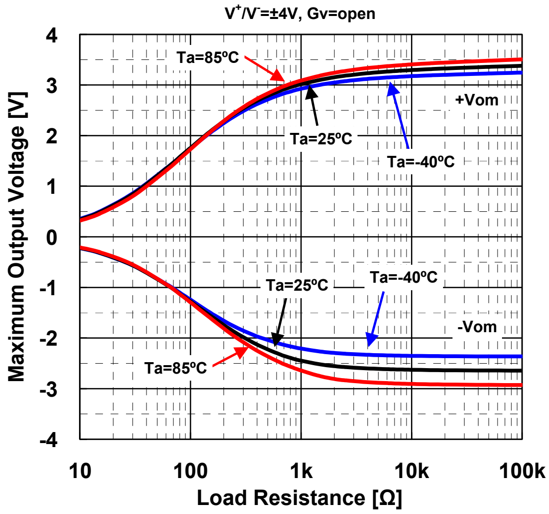

**Maximum Output Voltage vs. Load Resistance**
(Temperature)
$V^+/V^-$=±15V, Gv=open



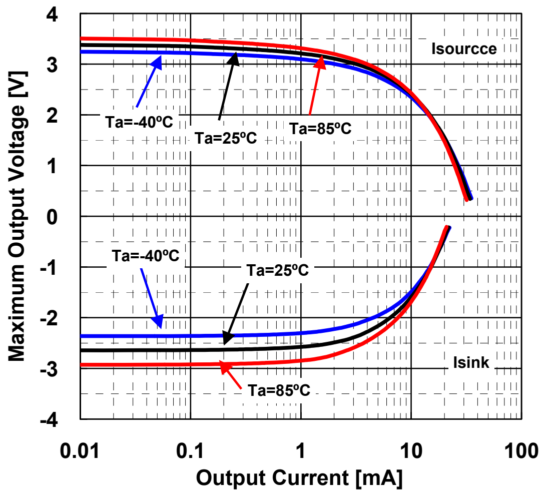

**Maximum Output Voltage vs. Output Current**
(Temperature)
$V^+/V^-$=±15V, Gv=open, calculated by Vom/$R_L$




**Maximum Output Voltage vs. Load Resistance**
(Temperature)
$V^+/V^-$=±4V, Gv=open



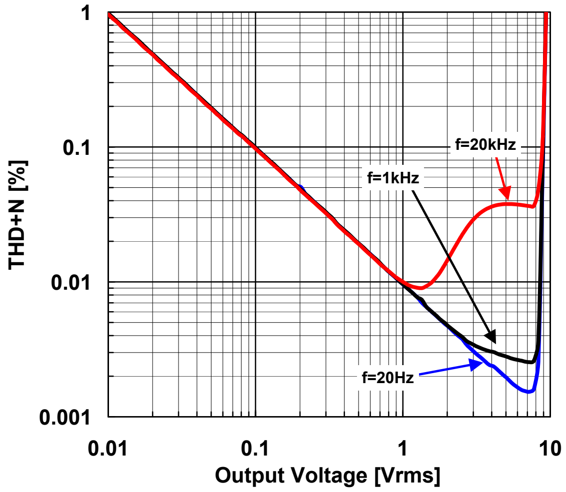

**Maximum Output Voltage vs. Output Current**
(Temperature)
$V^+/V^-$=±4V, Gv=open, calculated by Vom/$R_L$



## ■ TYPICAL CHARACTERISTICS

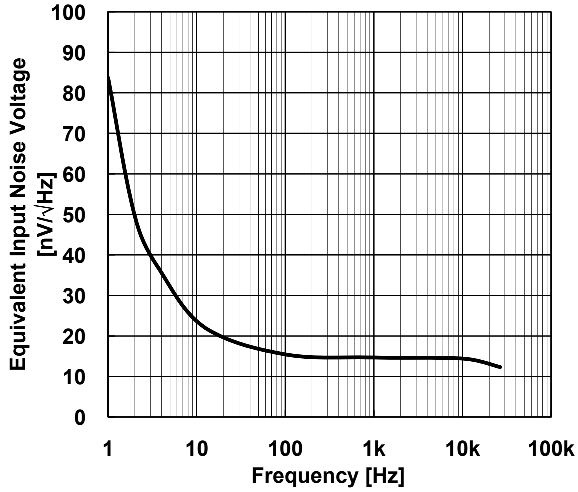
**THD+N vs. Output Voltage**

$V^+/V^-$=±15V, $A_V$=+10, $R_L$=2kΩ, Ta=25ºC



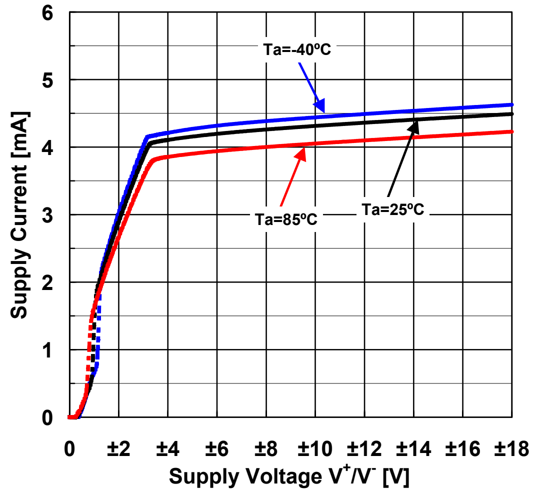

**Voltage Noise vs. Frequency**

$V^+/V^-$=±15V, $A_V$=+100, $R_S$=100Ω, $R_L$=∞, Ta=25ºC



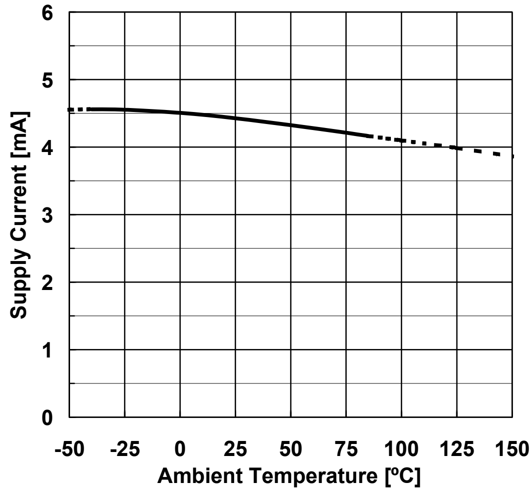

**Supply Current vs. Supply Voltage** (Temperature)

$G_V$=0dB, $V_{IN}$=0V



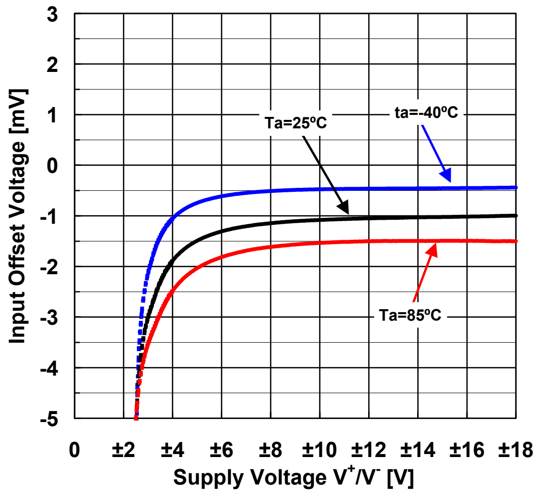

**Supply Current vs. Temperature**

$V^+/V^-$=±15V, $G_V$=0dB, $V_{IN}$=0V



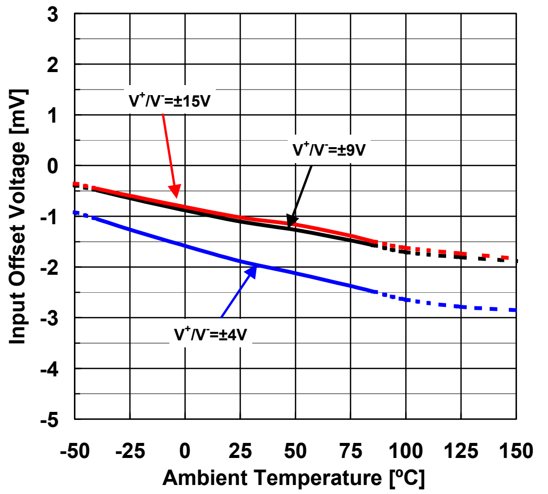

**Input Offset Voltage vs. Supply Voltage** (Temperature)

$V_{ICM}$=0V, $V_{IN}$=0V




**Input Offset Voltage vs. Temperature** (Supply Voltage)

$V_{ICM}$=0V, $V_{IN}$=0V



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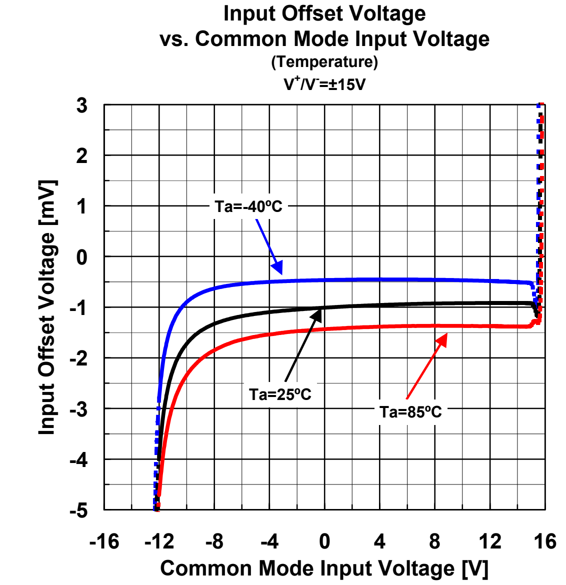


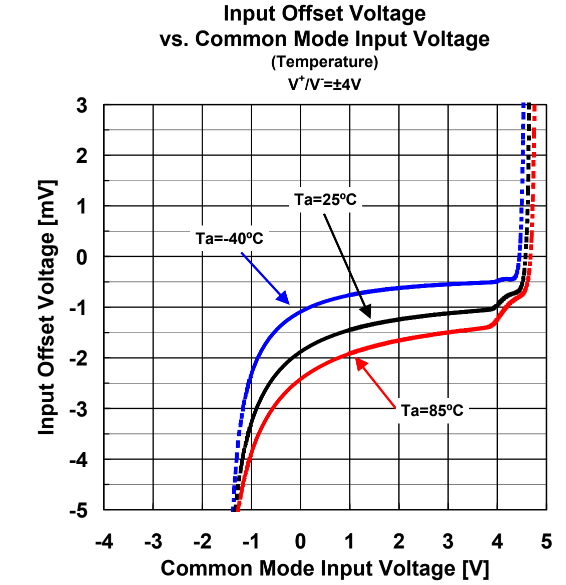


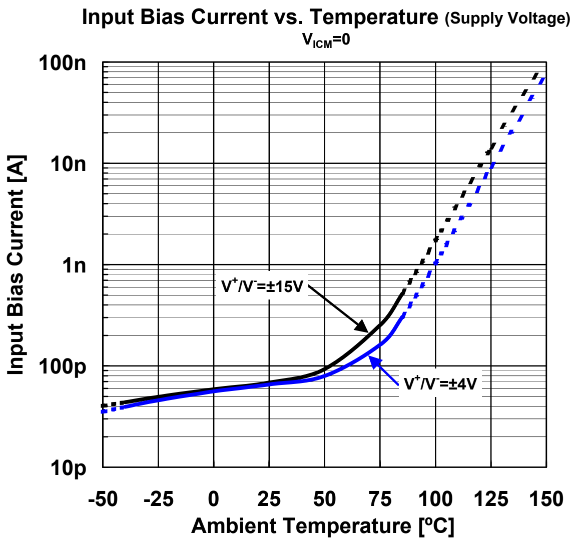


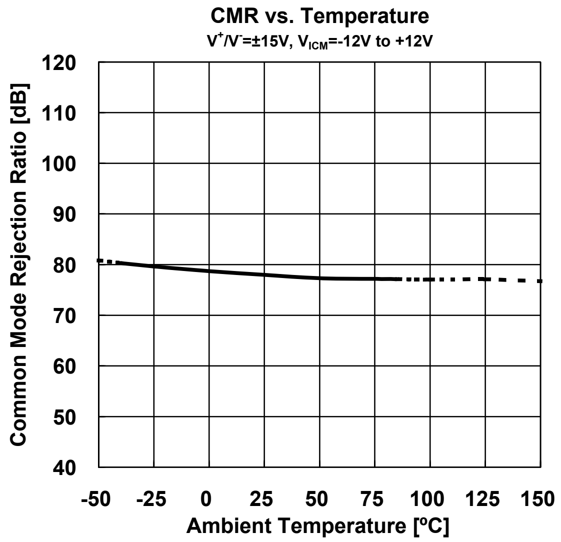


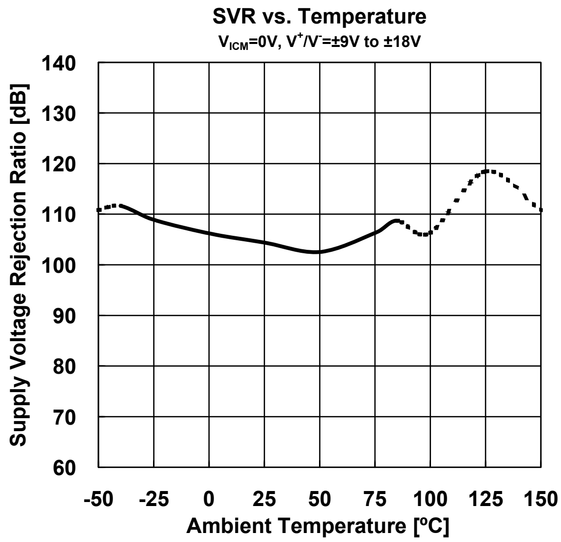


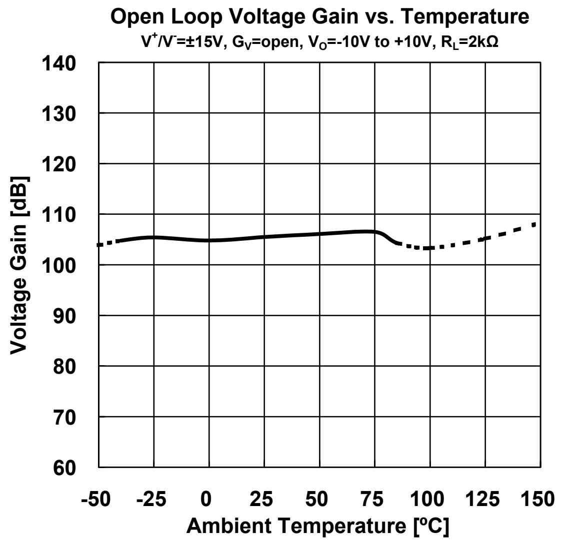

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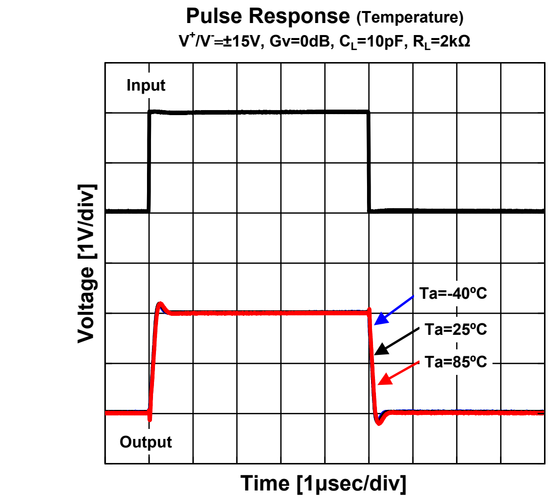


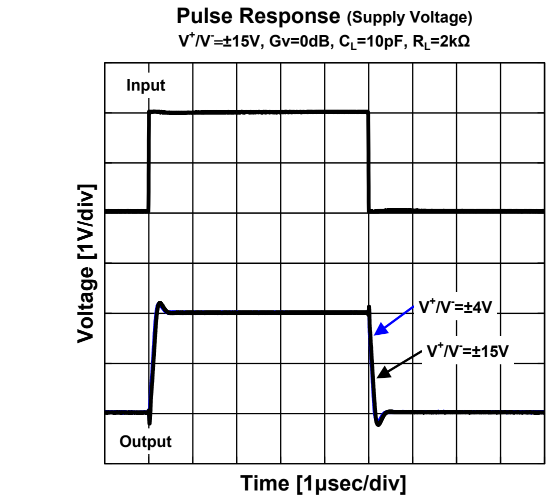


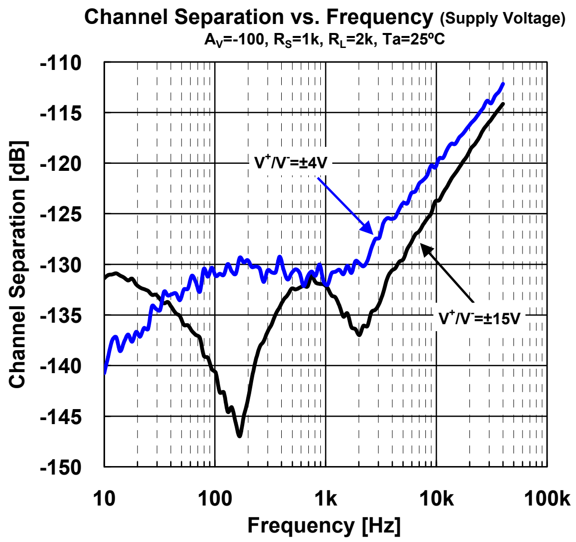


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