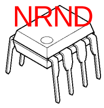
High Quality Audio
Dual Operational Amplifier

GENERAL DESCRIPTION

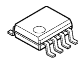
The **MUSES8820** is a high quality audio operational amplifier, which is optimized for high-end audio and professional audio applications.

It is the best for audio preamplifiers, active filters, and line amplifiers with excellent sound.

PACKAGE OUTLINE



MUSES8820D (DIP8)

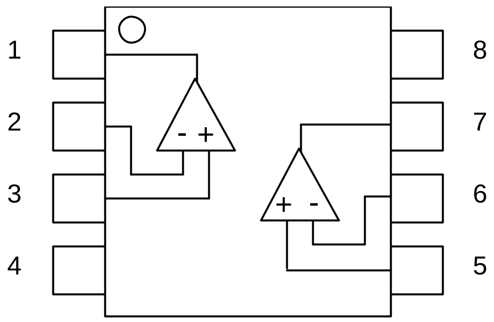


MUSES8820E (SOP8)

FEATURES

- ●Operating Voltage Vopr = ±3.5V to ±16V
- ●Output noise $4.5nV/\sqrt{Hz}$ at f=1kHz
- ●Input Offset Voltage 0.3mV typ. 3mV max.
- ●Input Bias Current 100nA typ. 500nA max. at Ta=25°C
- ●Voltage Gain 110dB typ.
- ●Slew Rate 5V/µs typ.
- ●Bipolar Technology
- ●Package Outline DIP8, SOP8 JEDEC 150mil

PIN CONFIGURATION



PIN FUNCTION

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

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+/V^-	±18	V
Common Mode Input Voltage	V_{ICM}	±15 (Note1)	V
Differential Input Voltage	V_{ID}	±30	V
Power Dissipation	P_D	DIP8 : 870 SOP8 : 900(Note2)	mW
Output Current	I_O	±50	mA
Operating Temperature Range	T_{opr}	-40 to +85	°C
Storage Temperature Range	T_{stg}	-50 to +150	°C

(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).

□RECOMMENDED OPERATING CONDITION (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V^+/V^-	-	±3.5	-	±16	V

□ELECTRIC CHARACTERISTICS

DC CHARACTERISTICS (V^+/V^-=±15V, Ta=25°C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	No Signal, $R_L=\infty$	-	8.0	12.0	mA
Input Offset Voltage	V_{IO}	Rs≤10kΩ (Note3)	-	0.3	3.0	mV
Input Bias Current	I_B	(Note3, 4)	-	100	500	nA
Input Offset Current	I_{IO}	(Note3, 4)	-	5	200	nA
Voltage Gain	A_V	R_L≥2kΩ, V_o=±10V Rs≤10kΩ	90	110	-	dB
Common Mode Rejection Ratio	CMR	V_{ICM}=±12V (Note5) Rs≤10kΩ	80	110	-	dB
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±3.5 to ±16.0V Rs≤10kΩ (Note3, 6)	80	110	-	dB
Max Output Voltage	V_{OM}	R_L=2kΩ	±12	±13.5	-	V
Input Common Mode Voltage Range	V_{ICM}	CMR≥80dB	±12	±13.5	-	V

(Note3) Measured at VICM=0V
(Note4) Written by the absolute rate.
(Note5) CMR is calculated by specified change in offset voltage. (VICM=0V to +12V and VICM=0V to −12V)
(Note6) SVR is calculated by specified change in offset voltage. (V+/V−=±3.5V to ±16V)

AC CHARACTERISTICS (V^+/V^-=±15V, Ta=25°C 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	-	5.8	-	MHz
Phase Margin	ϕ_M	A_V=+100, R_S=100Ω, R_L=2kΩ,C_L=10pF	-	48	-	deg
Input Noise Voltage1	V_{NI}	f=1kHz, A_V=+100, R_S=100Ω,R_L=∞	-	4.5	-	nV/√Hz
Input Noise Voltage2	V_{N2}	f=1kHz, A_V=+10 R_S =2.2kΩ, RIAA, 30kHz LPF	-	0.8	1.4	µVrms
Total Harmonic Distortion	THD	f=1kHz, A_V=+10, R_L=2kΩ, Vo=5Vrms	-	0.001	-	%
Channel Separation	CS	f=1kHz, A_V=-+100, R_S=1kΩ, R_L=2kΩ	-	140	-	dB
Positive Slew Rate	+SR	A_V=1, V_{IN}=2V_{p-p}, R_L=2kΩ, C_L=10pF	-	5	-	V/µs
Negative Slew Rate	-SR	A_V=1, V_{IN}=2V_{p-p}, R_L=2kΩ, C_L=10pF	-	5	-	V/µs

□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 of the MUSES8820 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 25°C, 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 25°C to it on 25°C. The P_D is shown following formula as a function of the ambient temperature between those points.

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

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 MUSES8820 is obtained using following equation.

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

The MUSES8820 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.

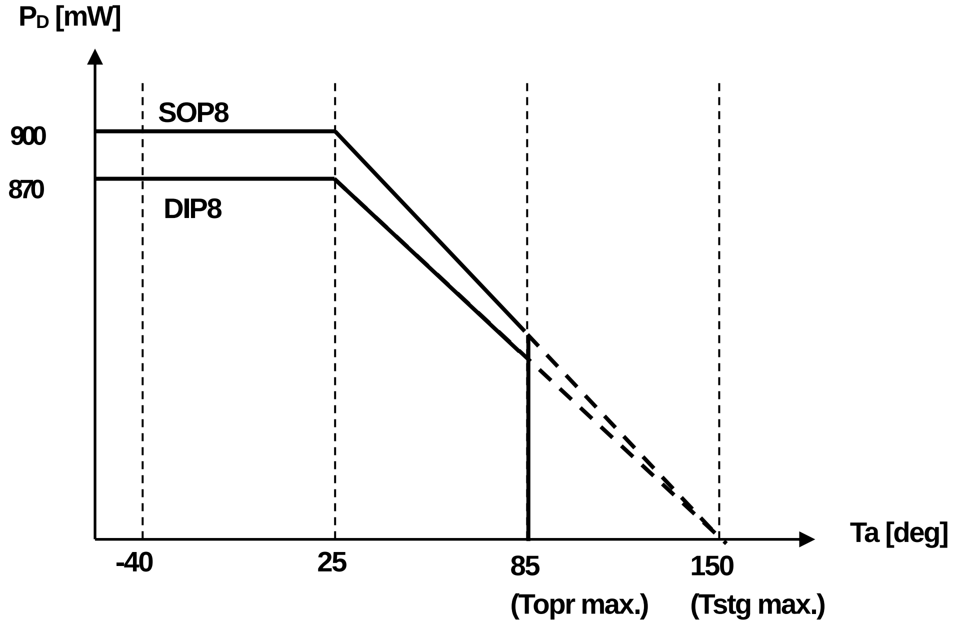
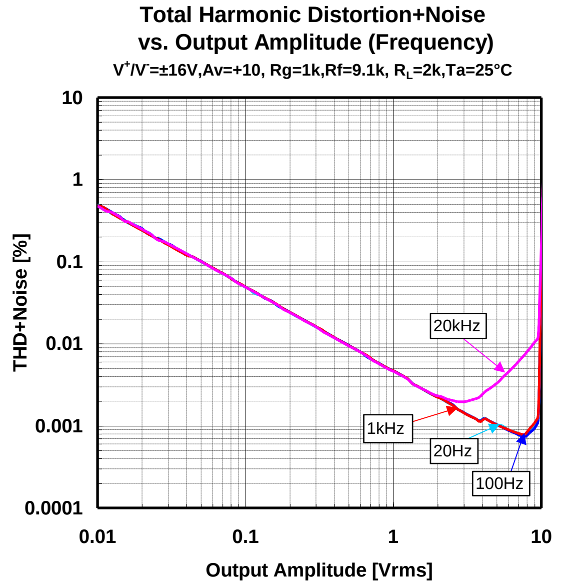
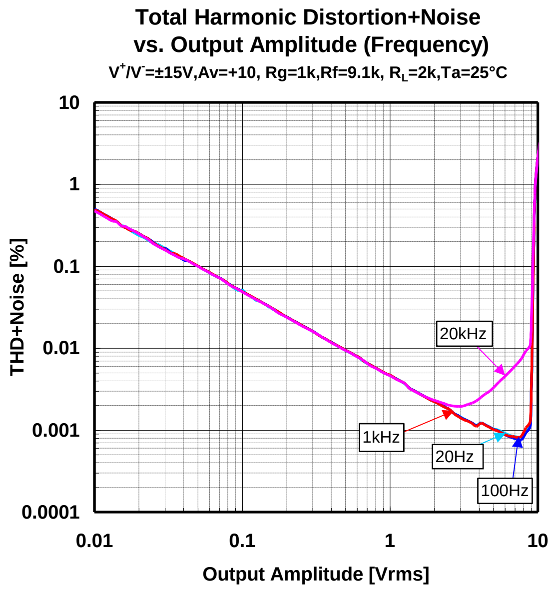
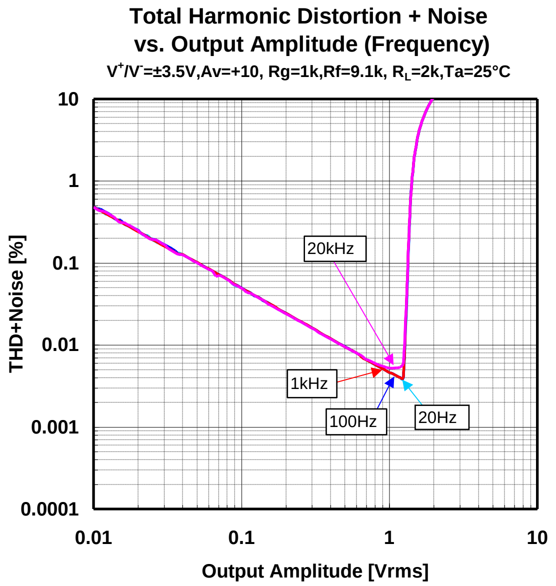


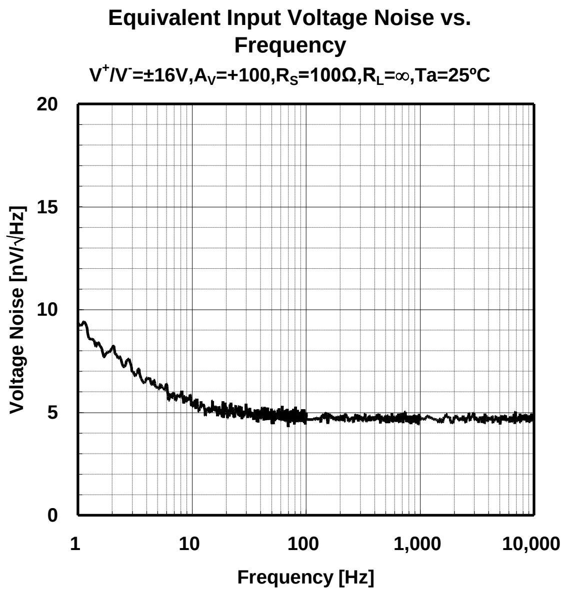
Fig.1 Power Dissipations vs. Ambient Temperature on the MUSES8820

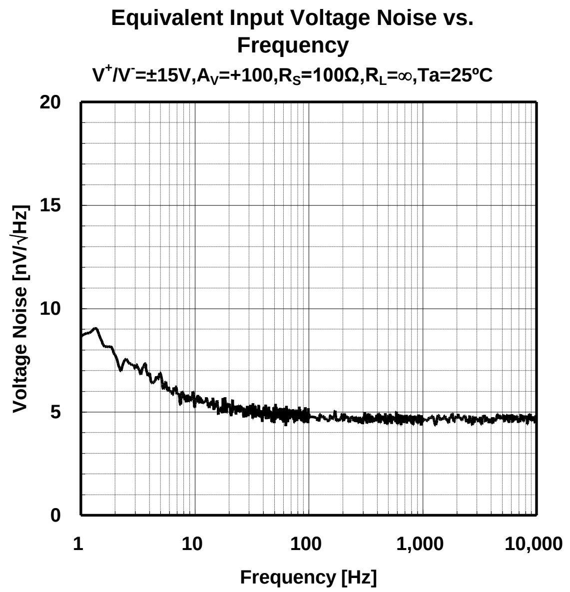
TYPICAL CHARACTERISTICS

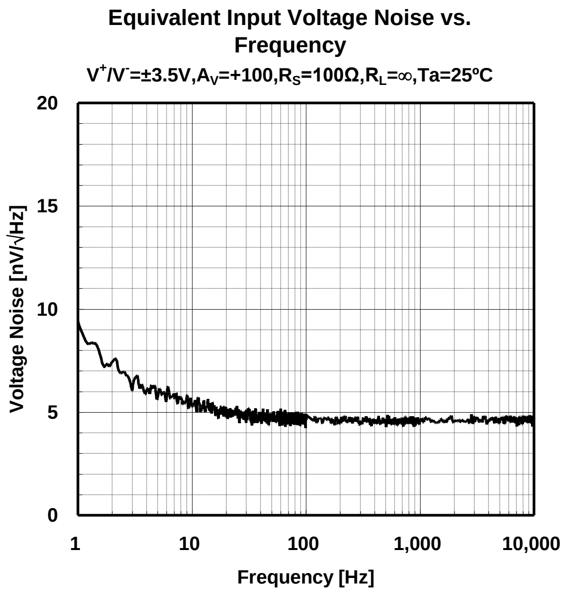






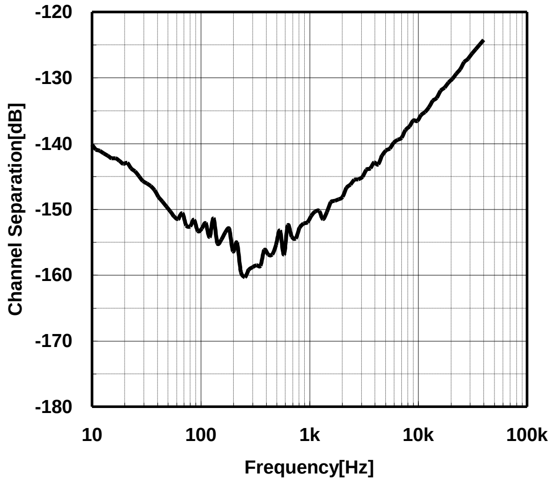






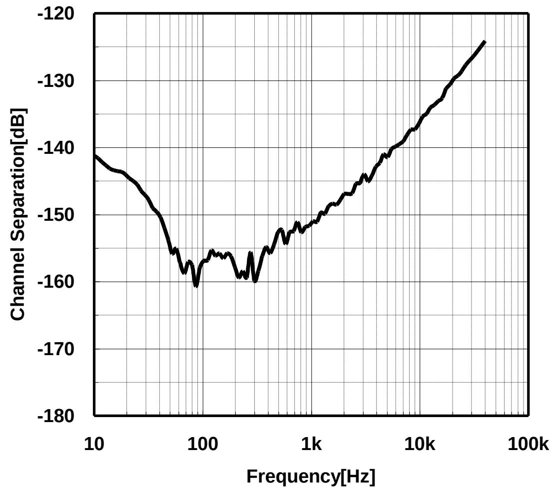
Channel Separation vs. Frequency

V^+/V^-=±16V,A_V=-100, R_S=1k, R_L=2k, Vo=5Vrms, Ta=25°C



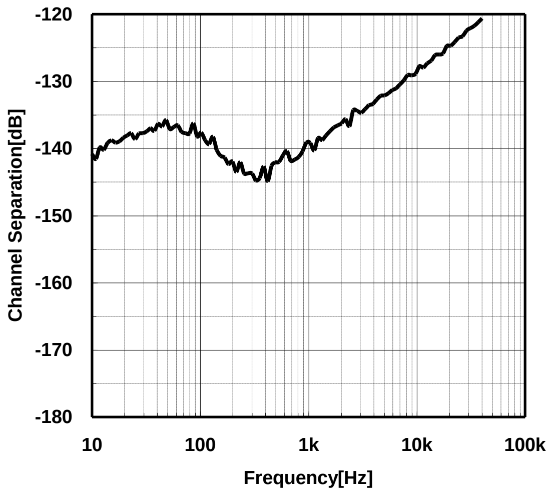
Channel Separation vs. Frequency

V^+/V^-=±15V, A_V=-100, R_S=1k, R_L=2k, Vo=5Vrms, Ta=25°C



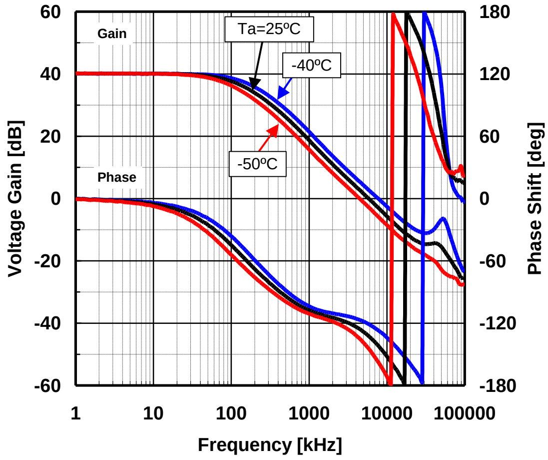
Channel Separation vs. Frequency

V^+/V^-=±3.5V,A_V=-100,R_S=1k,R_L=2k,Vo=1Vrms, Ta=25°C



Closed-Loop Gain/Phase vs. Frequency(Temperature)

V^+/V^-=±16V, A_V=+100, R_S=100, R_T=50, R_L=2k,C_L=10p
V_{IN}=-30dBm,Vicm=0V



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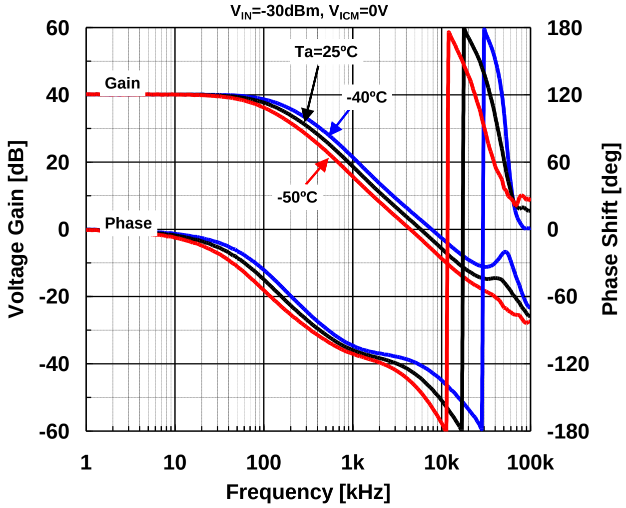
V_{IN}=-30dBm, V_{ICM}=0V



Closed-Loop Gain/Phase vs. Frequency(Temperature)

V^+/V^-=±3.5V, A_V=+100, R_S=100, R_T=50, R_L=2k,C_L=10p
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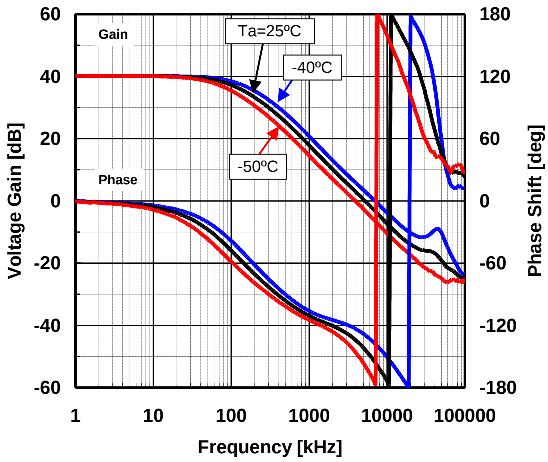
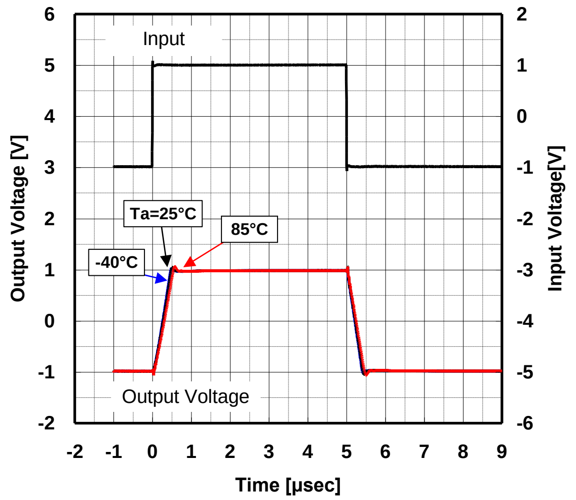


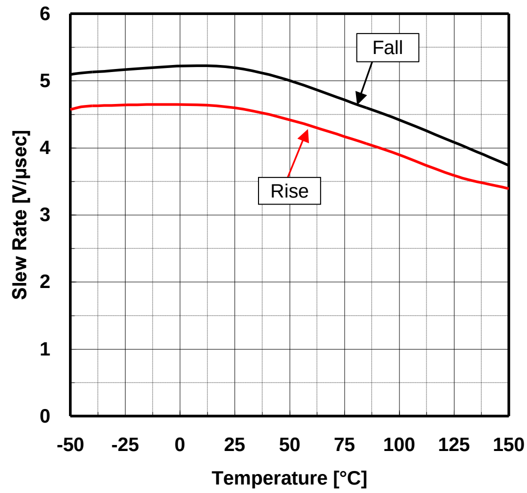
Transient Response (Temperature)

V^+/V^-=±16V,V_{IN}=2V_{P-P},f=100kHz
PulseEdge=10nsec,Gv=0dB,C_L=10p,R_L=2k



Slew Rate vs. Temperature

V^+/V^-=±16V,V_{IN}=2V_{P-P},f=100kHz
PulseEdge=10nsec,Gv=0dB,C_L=10p,R_L=2k



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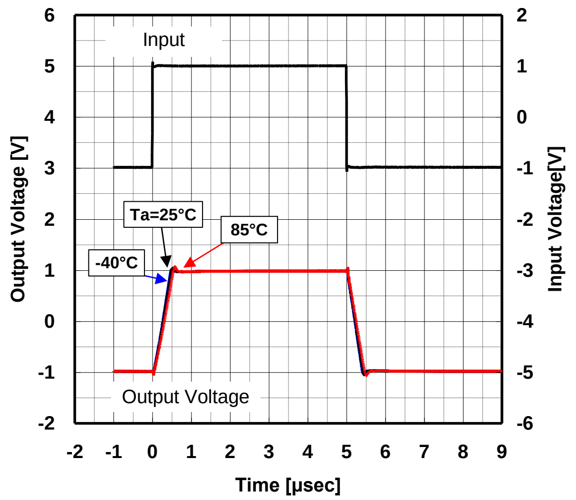

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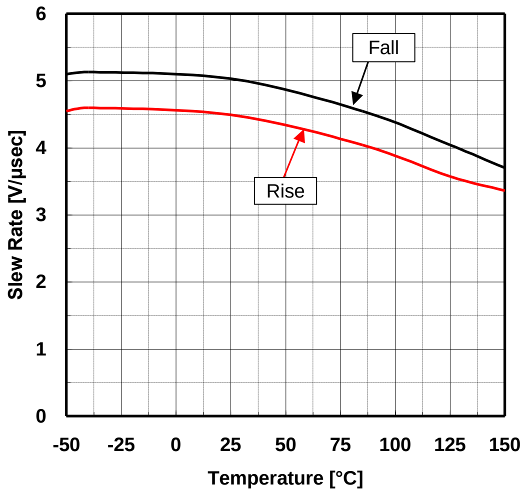

Transient Response (Temperature)

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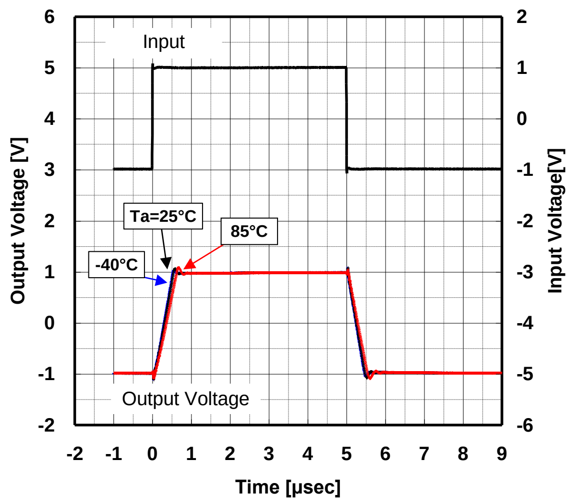
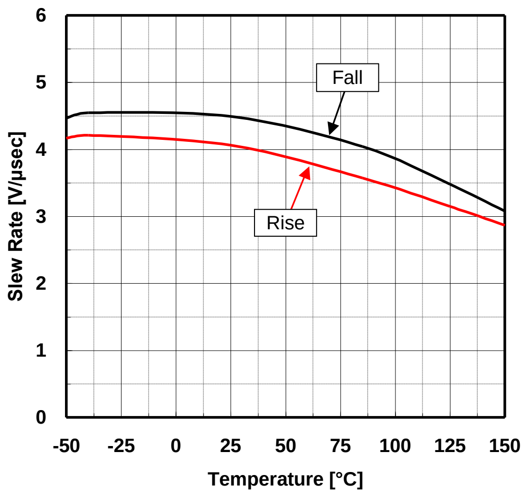
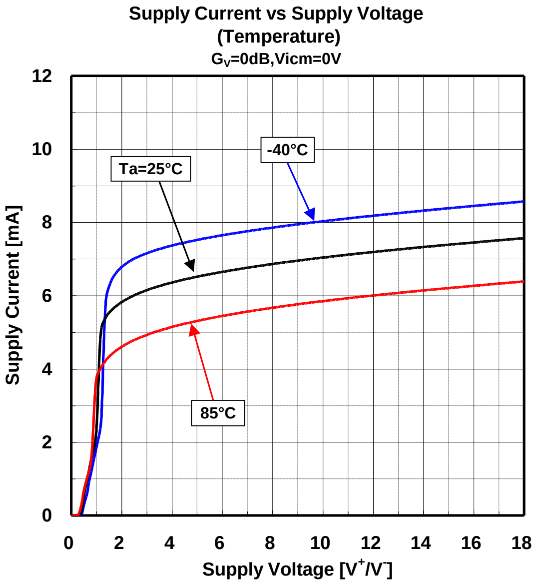
PulseEdge=10nsec,Gv=0dB,C_L=10p,R_L=2k

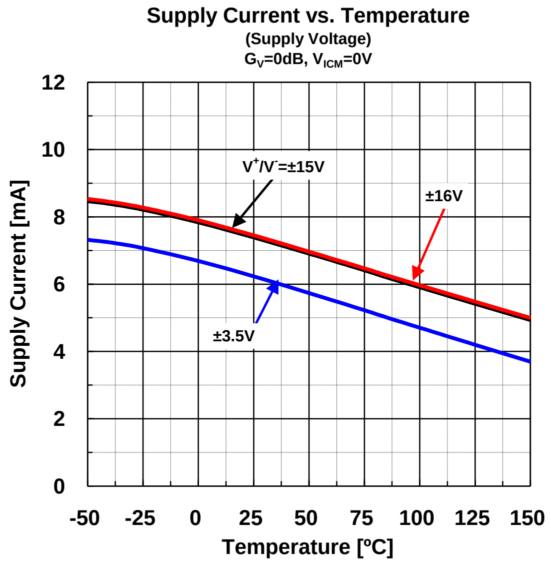


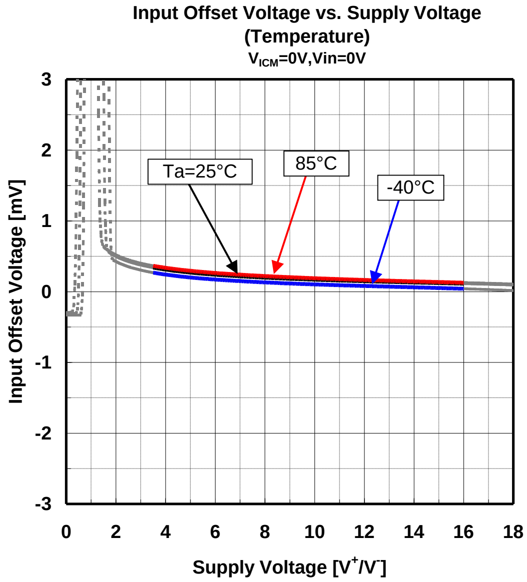
Slew Rate vs. Temperature

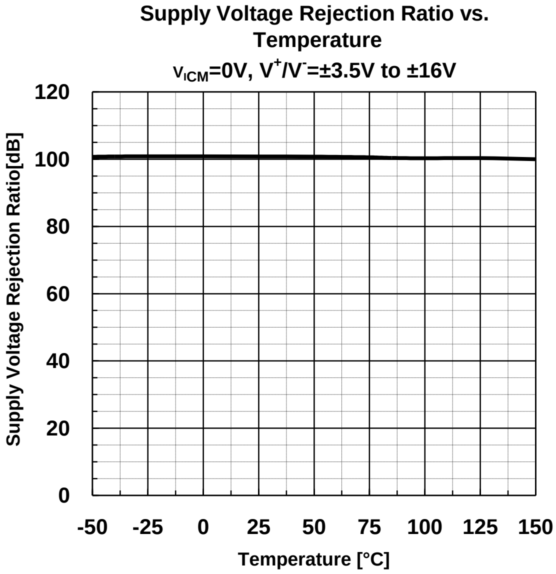
V^+/V^-=±3.5V,V_{IN}=2V_{P-P},f=100kHz
PulseEdge=10nsec,Gv=0dB,C_L=10p,R_L=2k

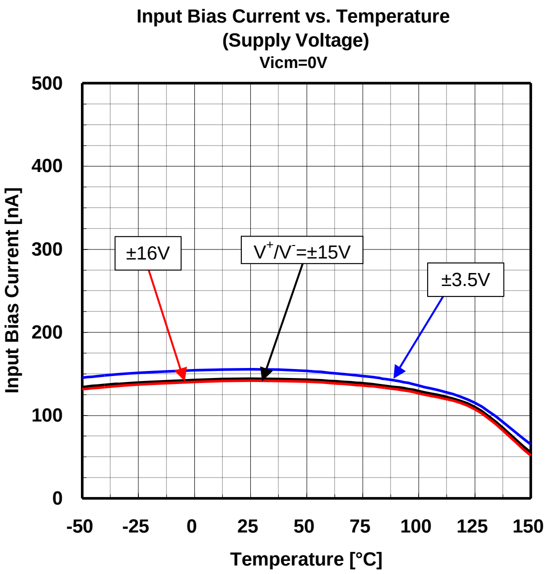


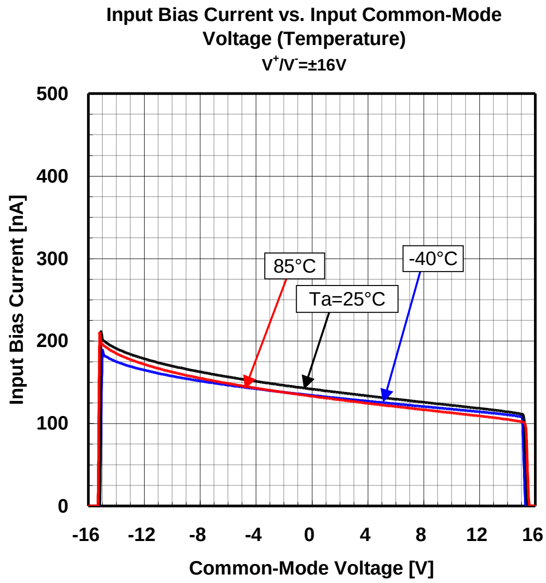

Supply Current vs Supply Voltage
(Temperature)
GV=0dB,Vicm=0V
Supply Current [mA]
Supply Voltage [V+/V-]
Ta=25°C
-40°C
85°C
0
2
4
6
8
10
12
14
16
18


Supply Current vs. Temperature
(Supply Voltage)
GV=0dB, VICM=0V
Supply Current [mA]
Temperature [ºC]
V+/V-=±15V
±16V
±3.5V
-50
-25
0
25
50
75
100
125
150

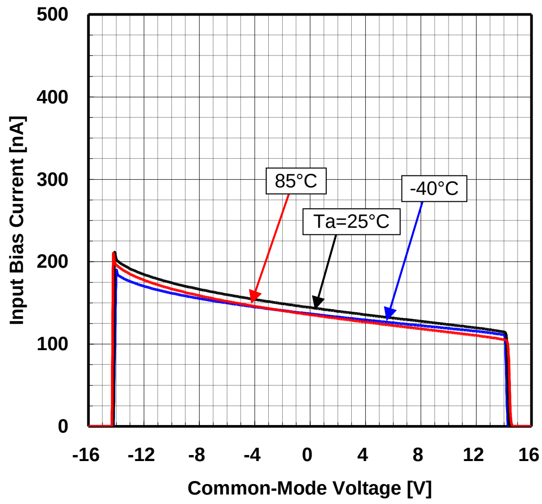

Input Offset Voltage vs. Supply Voltage
(Temperature)
VICM=0V,Vin=0V
Input Offset Voltage [mV]
Supply Voltage [V+/V-]
Ta=25°C
85°C
-40°C


Supply Voltage Rejection Ratio vs.
Temperature
VICM=0V, V+/V-=±3.5V to ±16V
Supply Voltage Rejection Ratio[dB]
Temperature [°C]

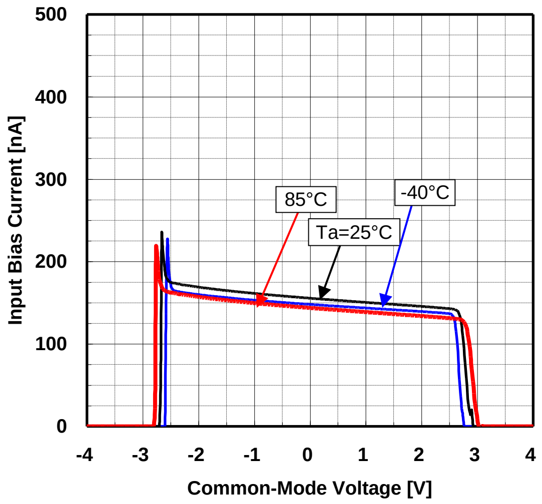

Input Bias Current vs. Temperature
(Supply Voltage)
Vicm=0V
Input Bias Current [nA]
Temperature [°C]
±16V
V+/V-=±15V
±3.5V


Input Bias Current vs. Input Common-Mode
Voltage (Temperature)
V+/V-=±16V
Input Bias Current [nA]
Common-Mode Voltage [V]
85°C
-40°C
Ta=25°C

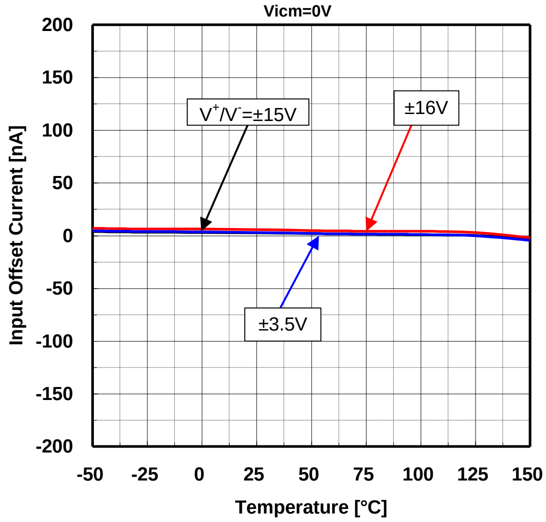
Input Bias Current vs. Input Common-Mode Voltage (Temperature)
$V^+/V^-=\pm15V$



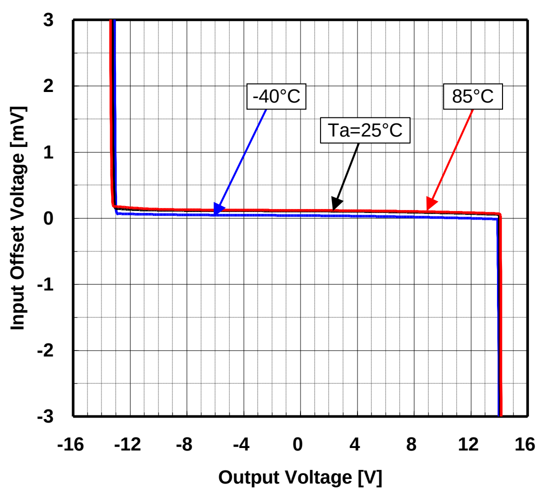
Input Bias Current vs. Input Common-Mode Voltage (Temperature)
$V^+/V^-=\pm3.5V$



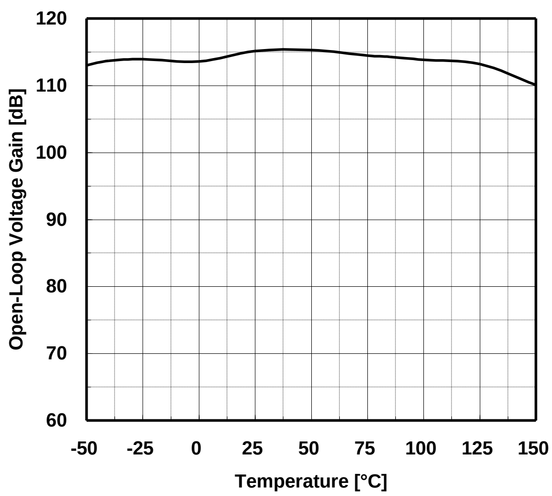
Input Offset Current vs. Temperature (Supply Voltage)
Vicm=0V



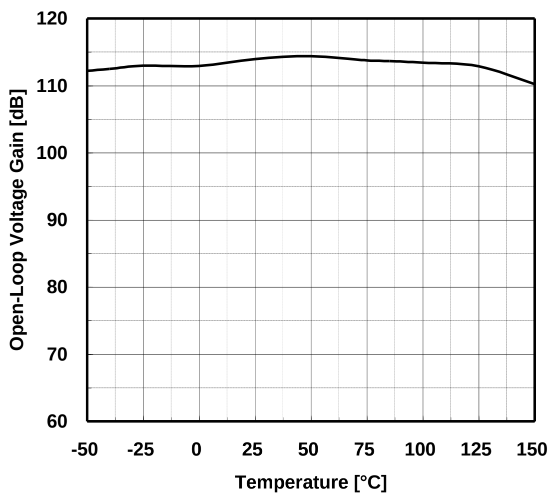
Input Offset Voltage vs. Output Voltage (Temperature)
$V^+/V^-=\pm15V$, $R_L=2k\Omega$ to 0V

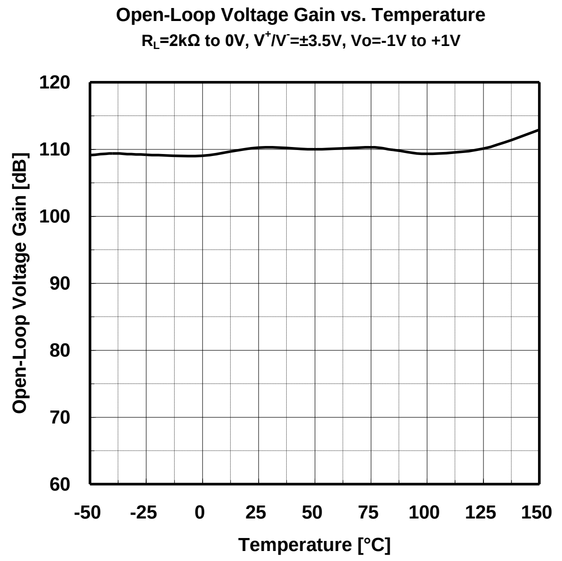


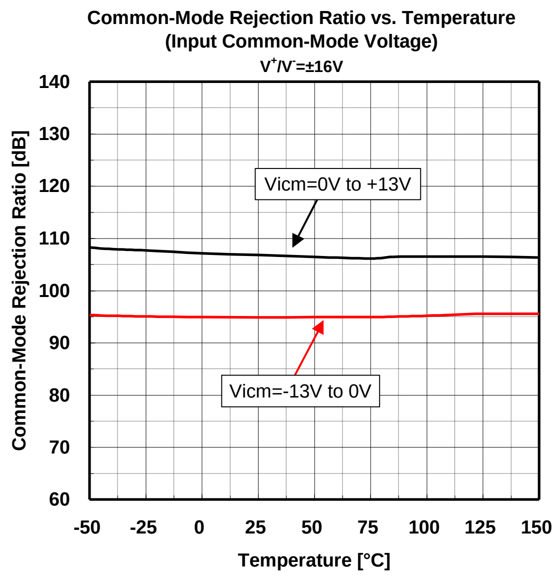
Open-Loop Voltage Gain vs. Temperature
$R_L=2k\Omega$ to 0V, $V^+/V^-=\pm16V$, Vo=-11V to +11V

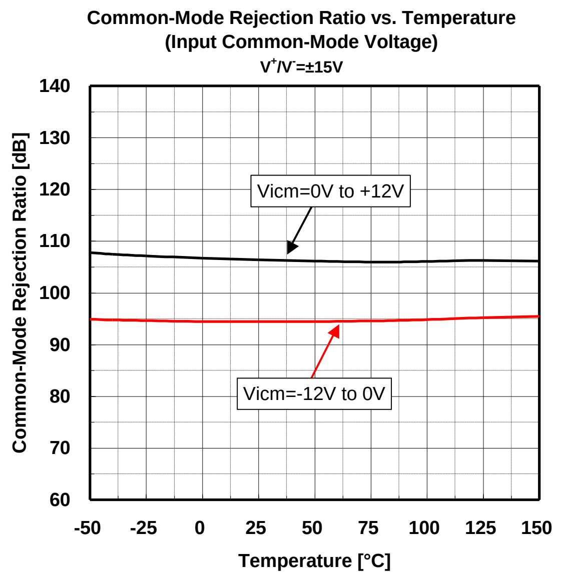


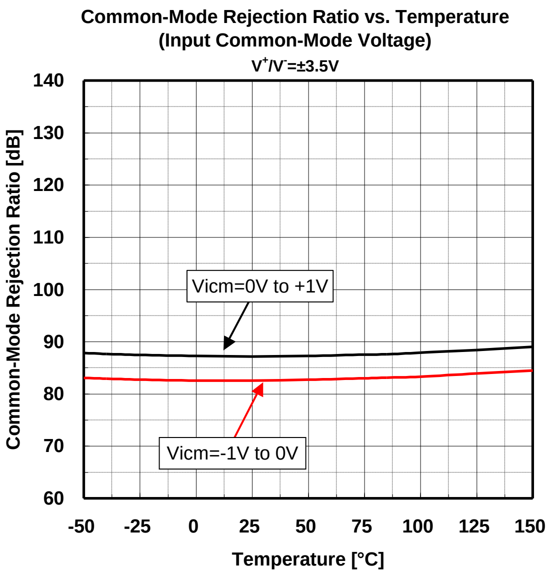
Open-Loop Voltage Gain vs. Temperature
$R_L=2k\Omega$ to 0V, $V^+/V^-=\pm15V$, Vo=-10V to +10V

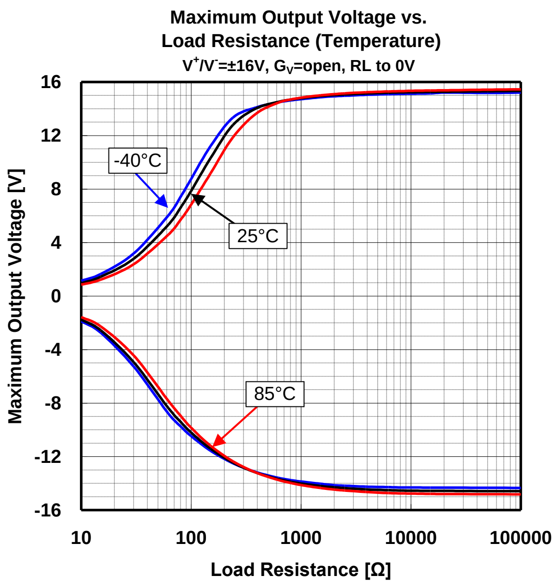


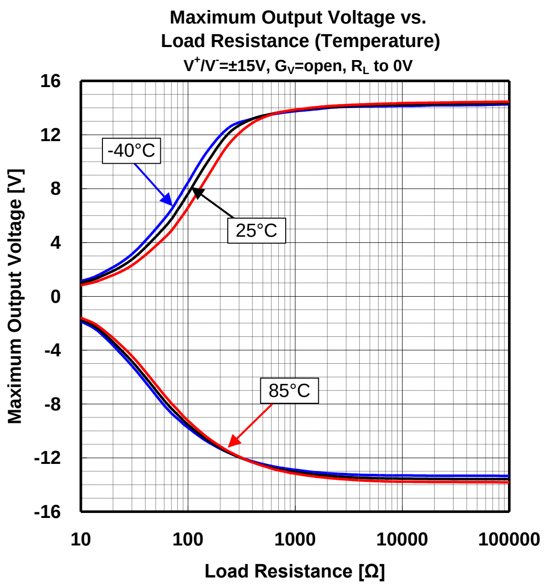

Open-Loop Voltage Gain vs. Temperature
RL=2kΩ to 0V, V+/V-=±3.5V, Vo=-1V to +1V
Open-Loop Voltage Gain [dB]
Temperature [°C]


Common-Mode Rejection Ratio vs. Temperature
(Input Common-Mode Voltage)
V+/V-=±16V
Vicm=0V to +13V
Vicm=-13V to 0V
Common-Mode Rejection Ratio [dB]
Temperature [°C]

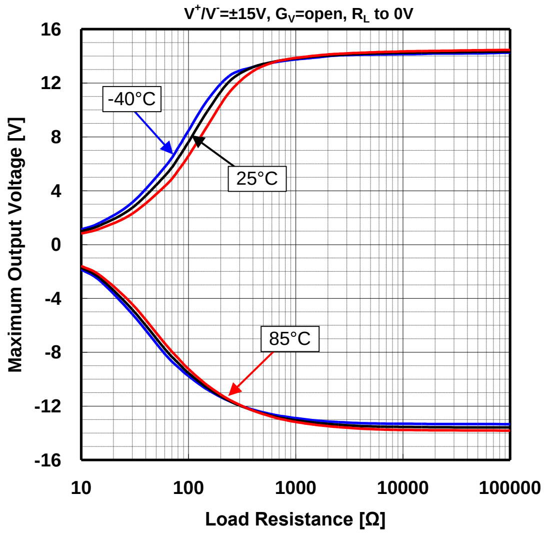

Common-Mode Rejection Ratio vs. Temperature
(Input Common-Mode Voltage)
V+/V-=±15V
Vicm=0V to +12V
Vicm=-12V to 0V
Common-Mode Rejection Ratio [dB]
Temperature [°C]


Common-Mode Rejection Ratio vs. Temperature
(Input Common-Mode Voltage)
V+/V-=±3.5V
Vicm=0V to +1V
Vicm=-1V to 0V
Common-Mode Rejection Ratio [dB]
Temperature [°C]

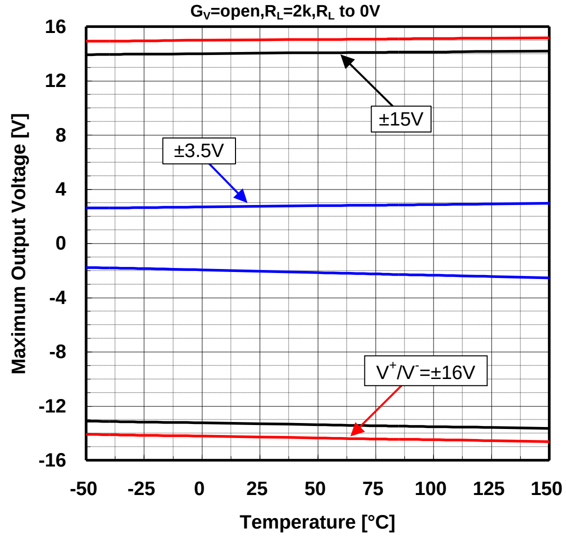

Maximum Output Voltage vs.
Load Resistance (Temperature)
V+/V-=±16V, GV=open, RL to 0V
-40°C
25°C
85°C
Maximum Output Voltage [V]
Load Resistance [Ω]


Maximum Output Voltage vs.
Load Resistance (Temperature)
V+/V-=±15V, GV=open, RL to 0V
-40°C
25°C
85°C
Maximum Output Voltage [V]
Load Resistance [Ω]

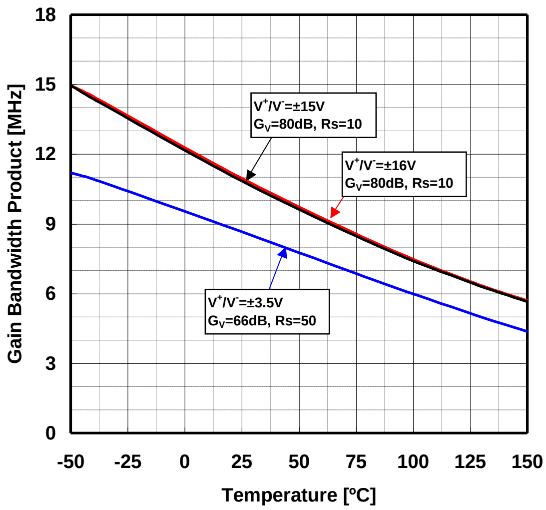
Maximum Output Voltage vs.
Load Resistance (Temperature)
V^+/V^-=±15V, G_V=open, R_L to 0V



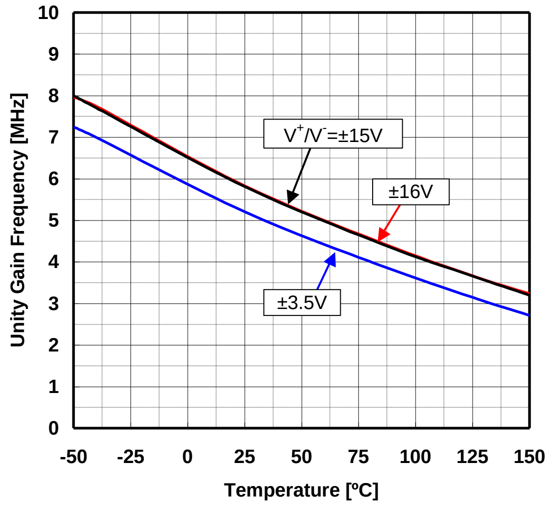
Maximum Output Voltage vs.
Temperature (Supply Voltage)
G_V=open,R_L=2k,R_L to 0V



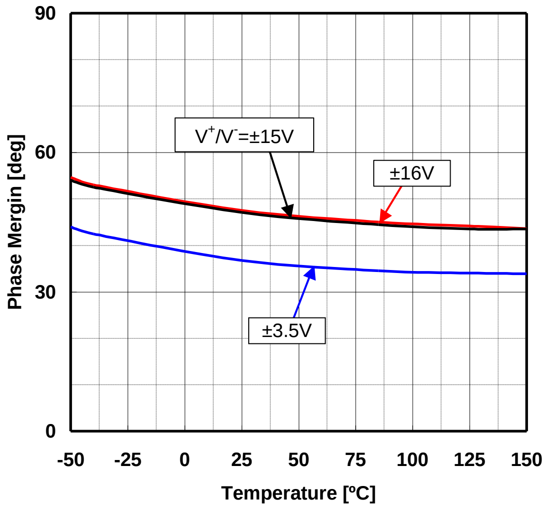
Gain Bandwidth Product vs. Temperature
R_T=50, f=10kHz, R_L=2k, C_L=10pF, Vin=-50dBm



Unity Gain Frequency vs. Temperature
A_V=+100, R_S=100, R_T=50,
R_L=2k,C_L=10pF,Vin=-30dBm



Phase Margin vs. Temperature
G_V=+100, R_S=100, R_T=50,
R_L=2k, C_L=10pF, Vin=-30dBm



MEMO