



High Quality Audio Dual Operational Amplifier

■ GENERAL DESCRIPTION

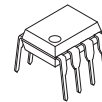
The **MUSES8820** is a high quality audio operational amplifier, which is optimized for high-end audio and professional audio applications.

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

■ FEATURES

- Operating Voltage $V_{opr} = \pm 3.5V$ to $\pm 16V$
- 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 $T_a=25^\circ C$
- Voltage Gain $110dB$ typ.
- Slew Rate $5V/\mu s$ typ.
- Bipolar Technology
- Package Outline DIP8, SOP8 JEDEC 150mil

■ PACKAGE OUTLINE

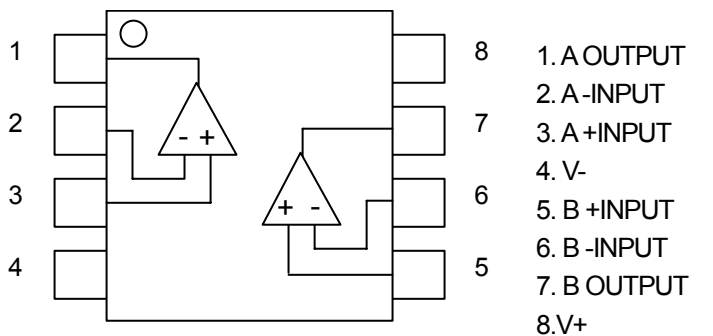


MUSES8820D
(DIP8)



MUSES8820E
(SOP8)

■ PIN CONFIGURATION



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MUSES8820

■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 ($V^+V^- = \pm 15V$, 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}	$R_s \leq 10k\Omega$ (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	$R_L \geq 2k\Omega$, $V_o = \pm 10V$ $R_s \leq 10k\Omega$	90	110	-	dB
Common Mode Rejection Ratio	CMR	$V_{ICM} = \pm 12V$ (Note5) $R_s \leq 10k\Omega$	80	110	-	dB
Supply Voltage Rejection Ratio	SVR	$V^+V^- = \pm 3.5$ to $\pm 16.0V$ $R_s \leq 10k\Omega$ (Note3, 6)	80	110	-	dB
Max Output Voltage	V_{OM}	$R_L = 2k\Omega$	±12	±13.5	-	V
Input Common Mode Voltage Range	V_{ICM}	CMR ≥ 80dB	±12	±13.5	-	V

(Note3) Measured at $V_{ICM} = 0V$

(Note4) Written by the absolute rate.

(Note5) CMR is calculated by specified change in offset voltage. ($V_{ICM} = 0V$ to +12V and $V_{ICM} = 0V$ to -12V)

(Note6) SVR is calculated by specified change in offset voltage. ($V^+V^- = \pm 3.5V$ to $\pm 16V$)

AC CHARACTERISTICS ($V^+V^- = \pm 15V$, $T_a = 25^\circ C$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GB	$f = 10kHz$	-	11	-	MHz
Unity Gain Frequency	f_T	$A_V = +100, R_S = 100\Omega,$ $R_L = 2k\Omega, C_L = 10pF$	-	5.8	-	MHz
Phase Margin	ϕ_M	$A_V = +100, R_S = 100\Omega,$ $R_L = 2k\Omega, C_L = 10pF$	-	48	-	deg
Input Noise Voltage1	V_{NI}	$f = 1kHz, A_V = +100,$ $R_S = 100\Omega, R_L = \infty$	-	4.5	-	nV/ \sqrt{Hz}
Input Noise Voltage2	V_{N2}	$f = 1kHz, A_V = +10$ $R_S = 2.2k\Omega,$ RIAA, 30kHz LPF	-	0.8	1.4	μV_{rms}
Total Harmonic Distortion	THD	$f = 1kHz, A_V = +10,$ $R_L = 2k\Omega, V_o = 5V_{rms}$	-	0.001	-	%
Channel Separation	CS	$f = 1kHz, A_V = +100,$ $R_S = 1k\Omega, R_L = 2k\Omega$	-	140	-	dB
Positive Slew Rate	+SR	$A_V = 1, V_{IN} = 2V_{p-p},$ $R_L = 2k\Omega, C_L = 10pF$	-	5	-	V/ μs
Negative Slew Rate	-SR	$A_V = 1, V_{IN} = 2V_{p-p},$ $R_L = 2k\Omega, C_L = 10pF$	-	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 T_{jmax} to the storage temperature T_{stg} 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.

$$\text{Dissipation Power } P_D = \frac{T_{jmax} - T_a}{\theta_{ja}} \text{ [W]} \quad (T_a=25^\circ\text{C to } T_a=150^\circ\text{C})$$

Where, θ_{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 MUSES8820 is obtained using following equation.

$$(\text{Actual Dissipation Power}) = (\text{Supply Current } I_{cc}) \times (\text{Supply Voltage } V^+ - V) - (\text{Output Power } P_o)$$

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.

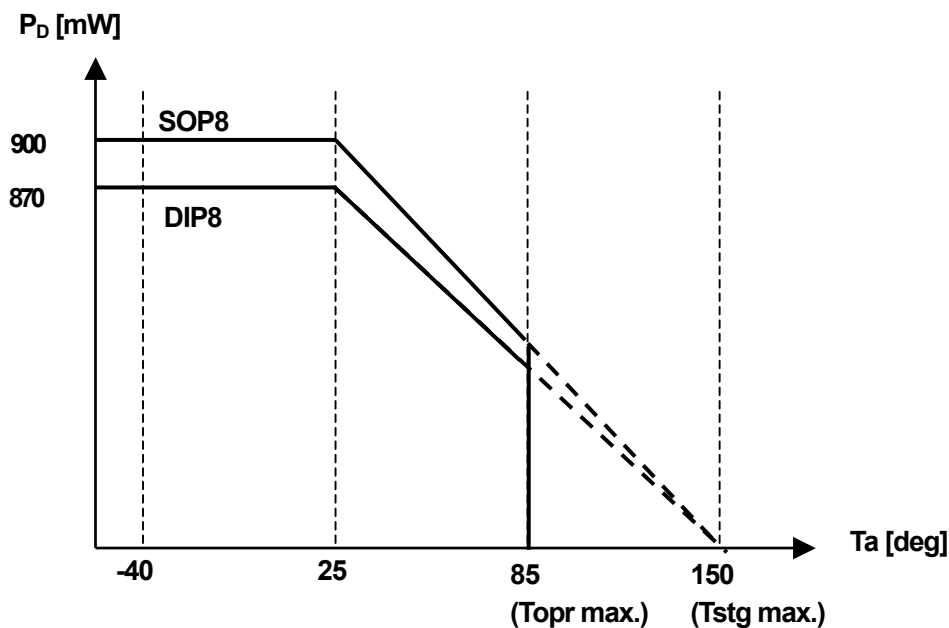
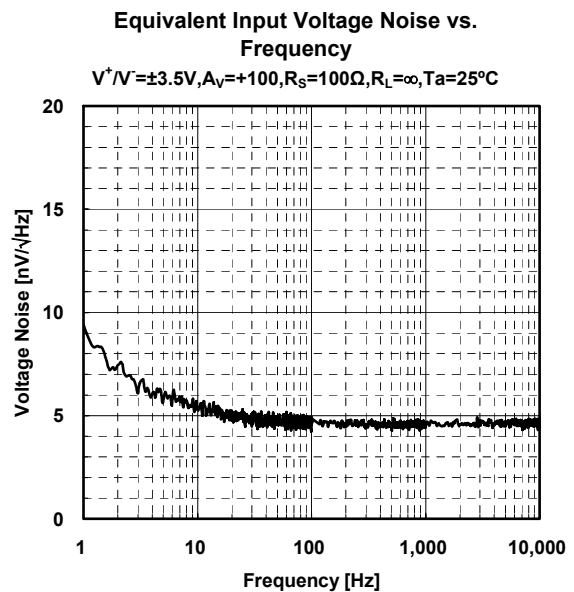
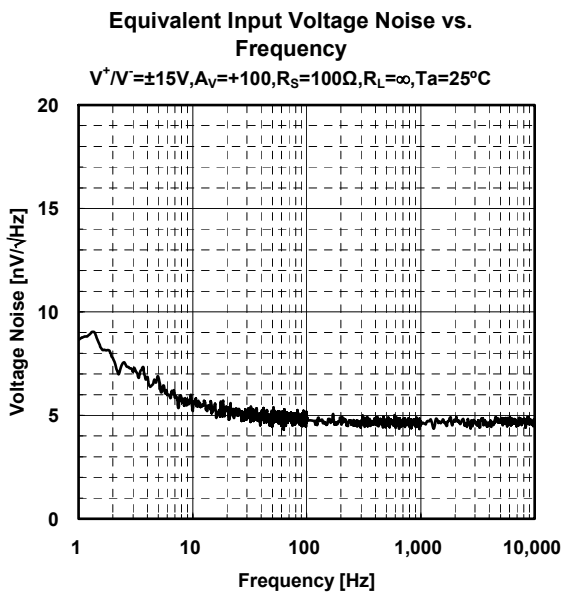
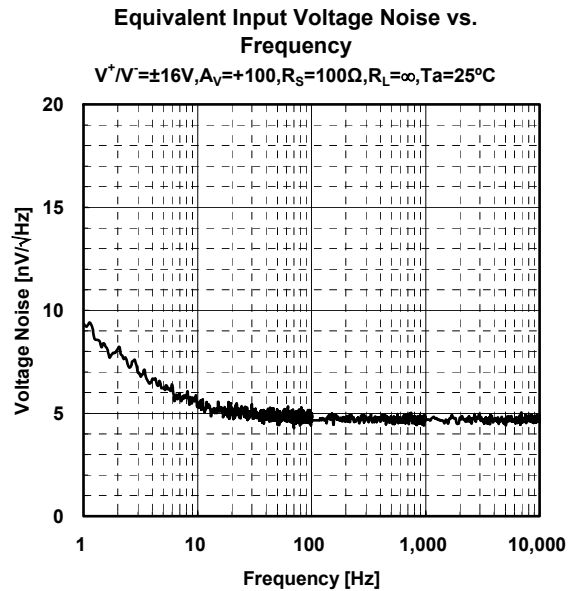
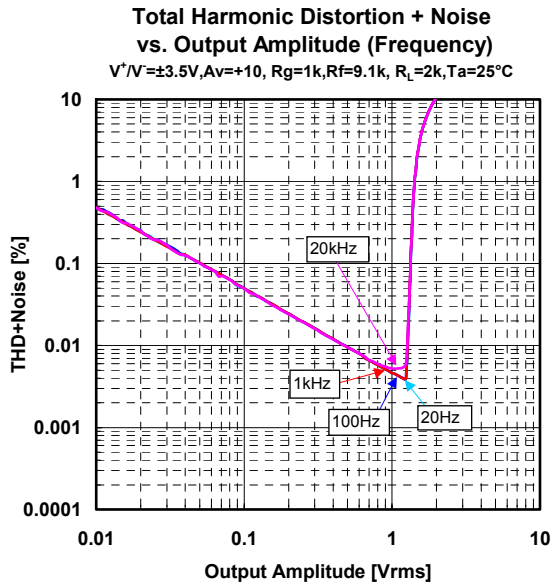
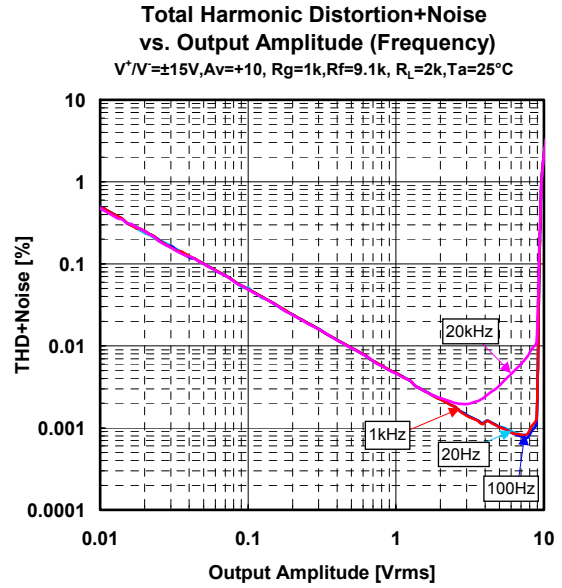
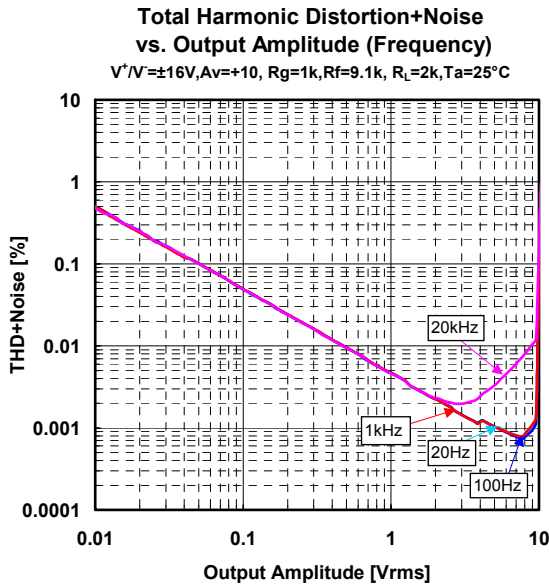
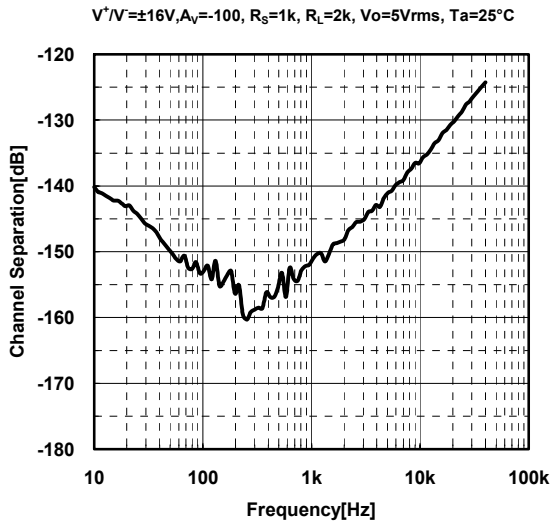


Fig.1 Power Dissipations vs. Ambient Temperature on the MUSES8820

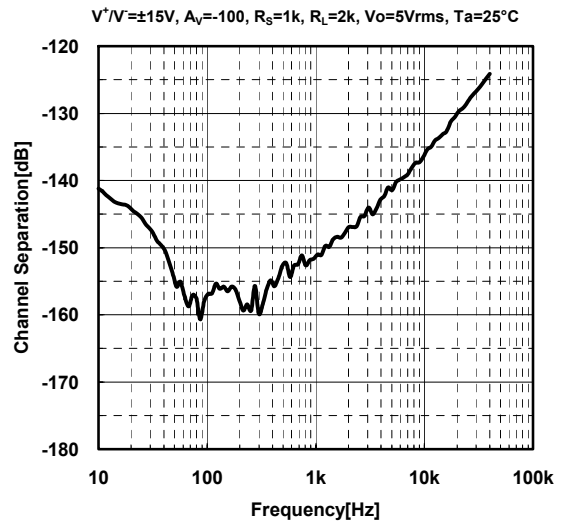
TYPICAL CHARACTERISTICS



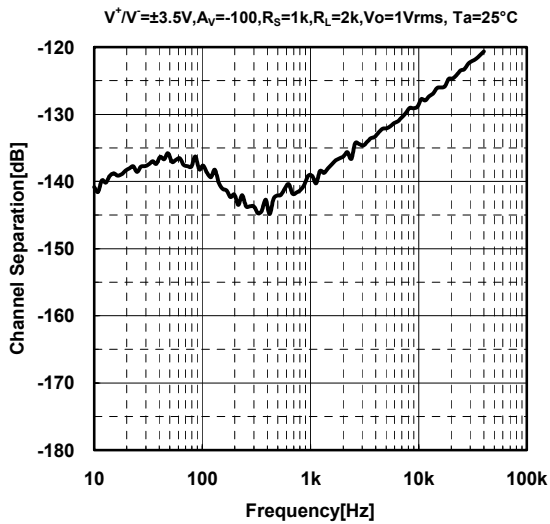
Channel Separation vs. Frequency



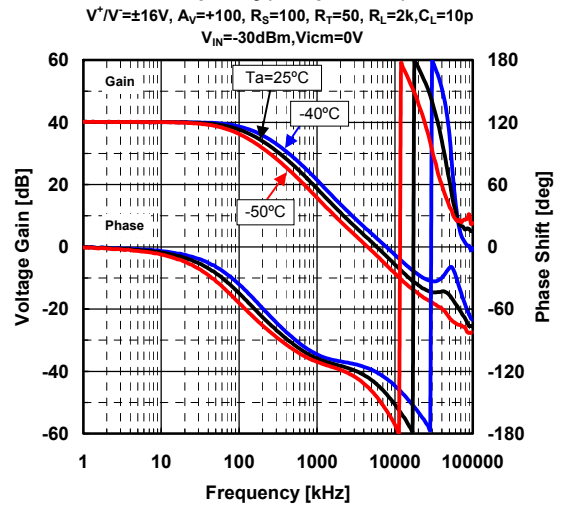
Channel Separation vs. Frequency



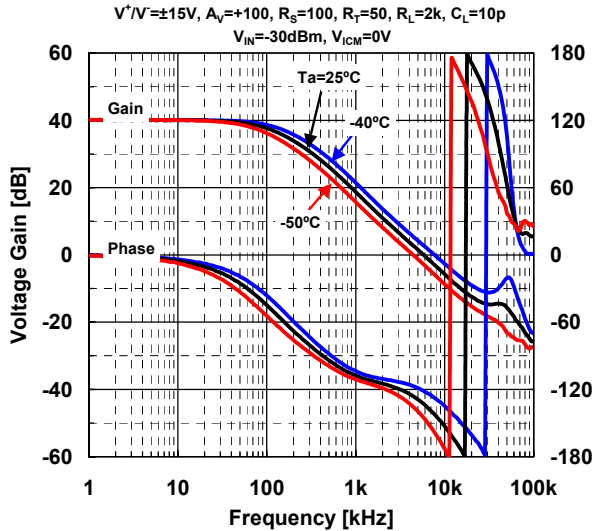
Channel Separation vs. Frequency



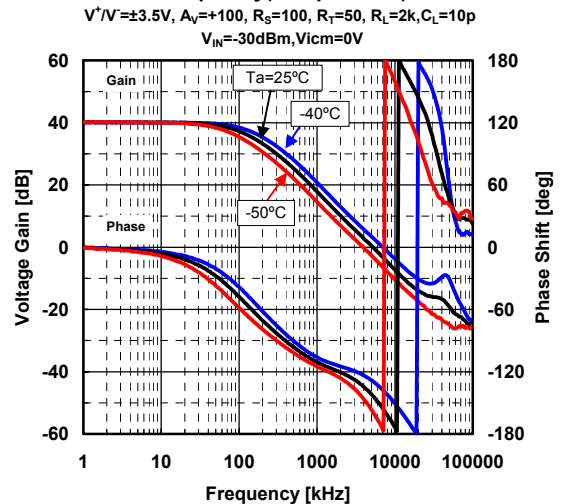
Closed-Loop Gain/Phase vs. Frequency (Temperature)



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

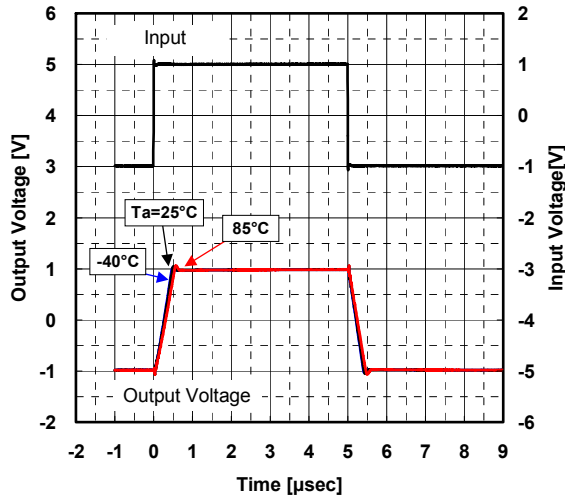


Closed-Loop Gain/Phase vs. Frequency (Temperature)



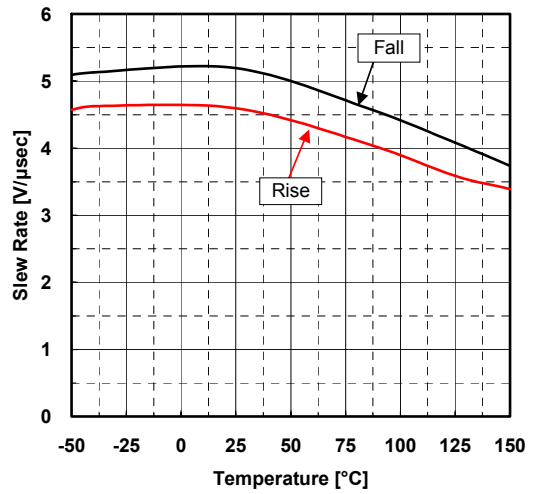
Transient Response (Temperature)

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



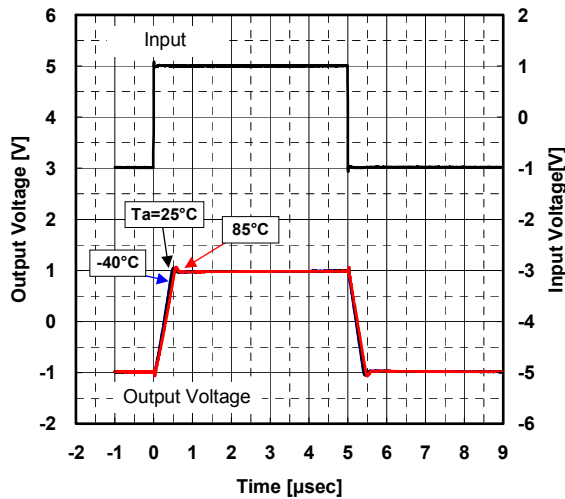
Slew Rate vs. Temperature

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



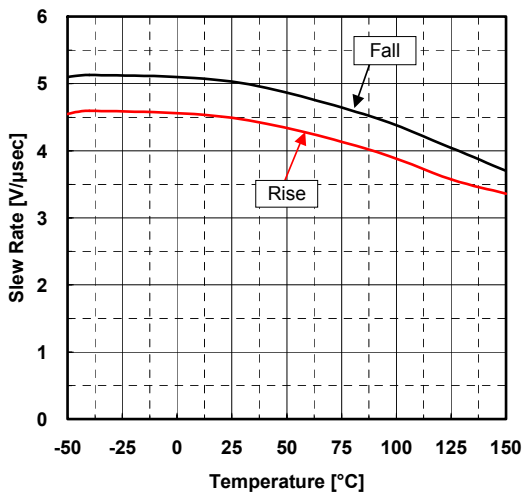
Transient Response (Temperature)

$V^+ / V^- = \pm 15V, V_{IN} = 2V_{P-P}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10p, R_L = 2k$



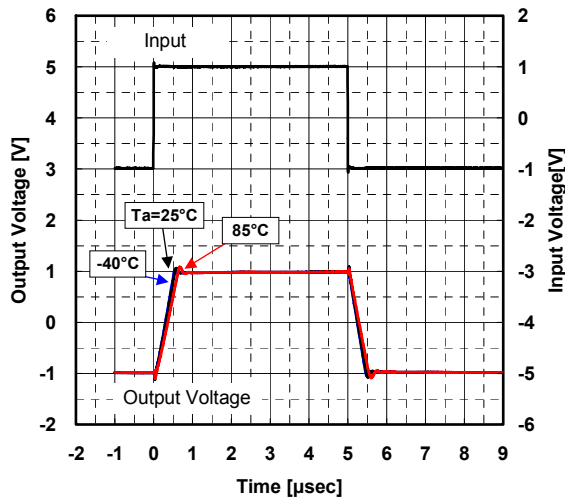
Slew Rate vs. Temperature

$V^+ / V^- = \pm 15V, V_{IN} = 2V_{P-P}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10p, R_L = 2k$



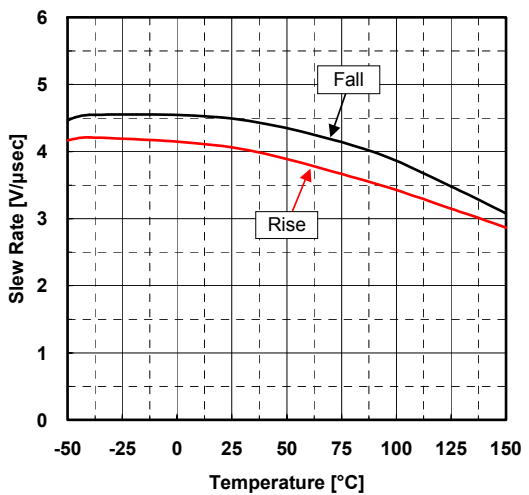
Transient Response (Temperature)

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

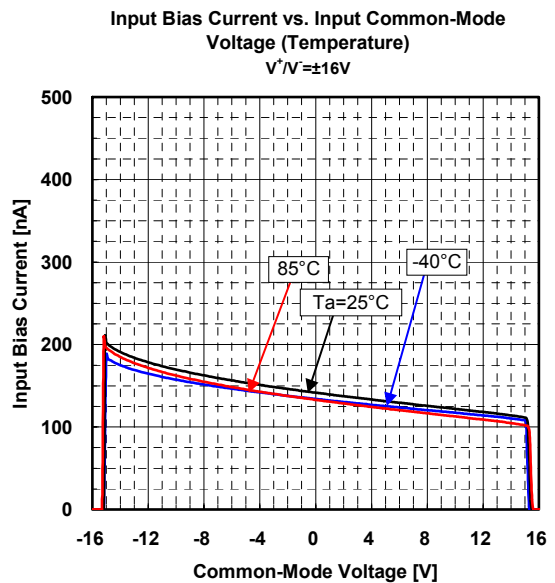
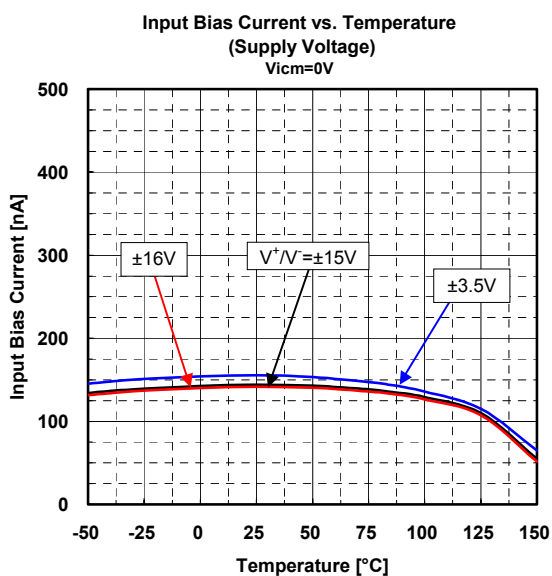
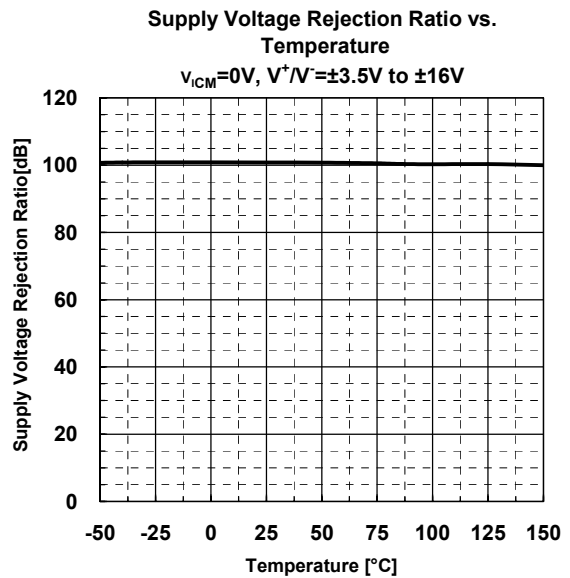
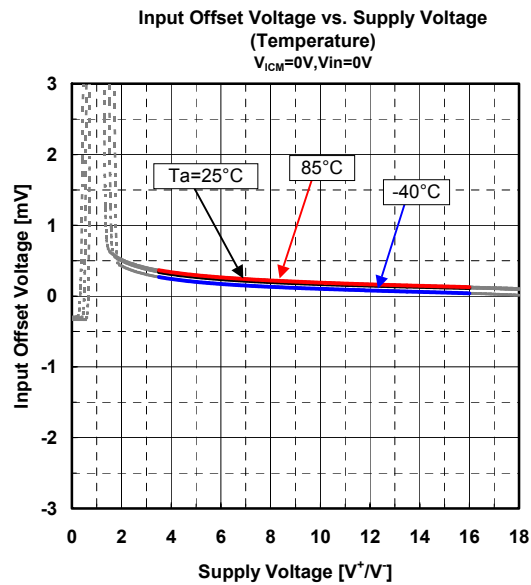
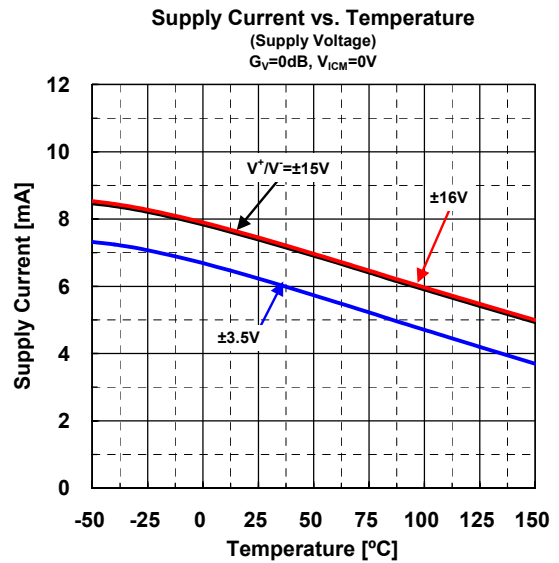
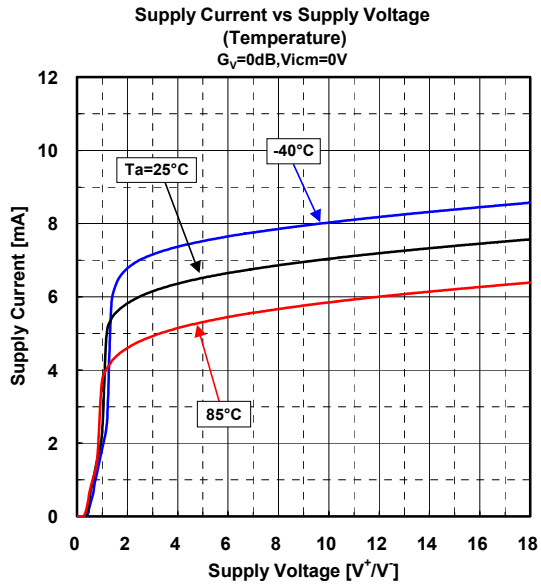


Slew Rate vs. Temperature

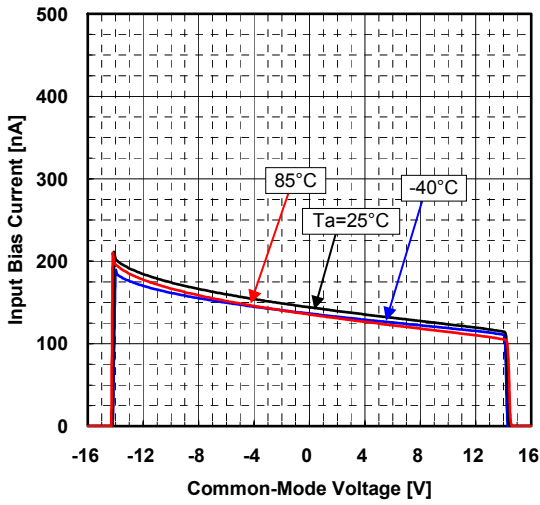
$V^+ / V^- = \pm 3.5V, V_{IN} = 2V_{P-P}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10p, R_L = 2k$



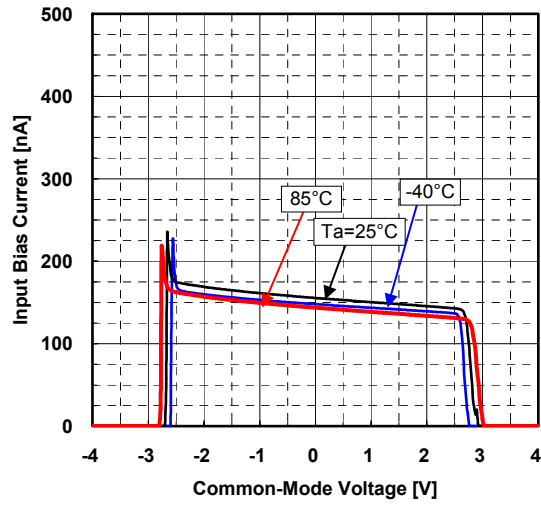
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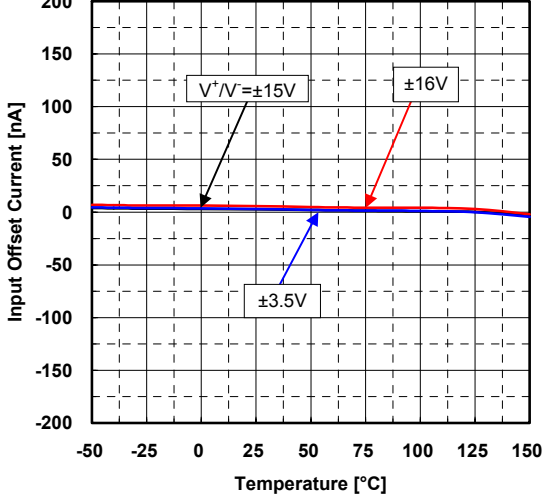
Input Bias Current vs. Input Common-Mode Voltage (Temperature)
 $V^+/V^-=\pm 15V$



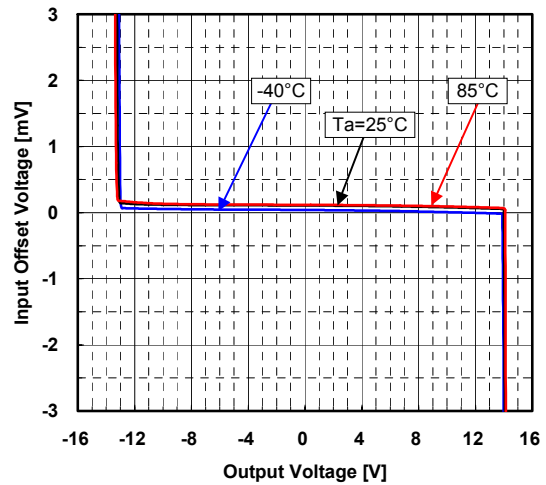
Input Bias Current vs. Input Common-Mode Voltage (Temperature)
 $V^+/V^-=\pm 3.5V$



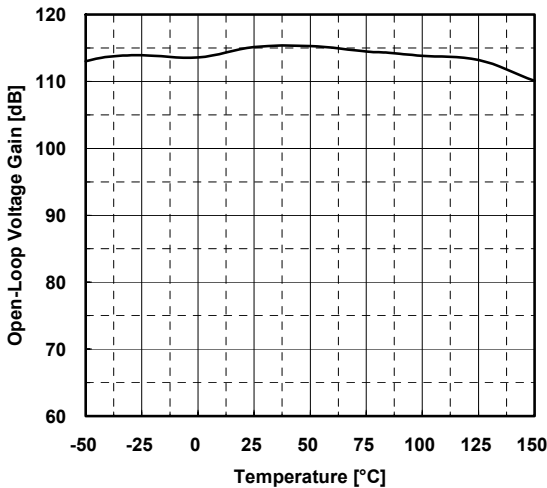
Input Offset Current vs. Temperature (Supply Voltage)
 $V_{icm}=0V$



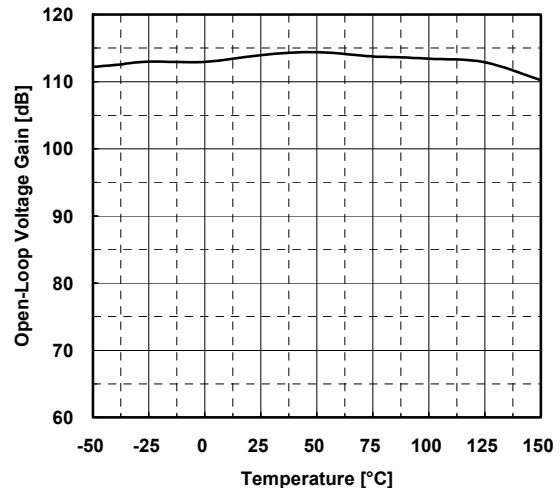
Input Offset Voltage vs. Output Voltage (Temperature)
 $V^+/V^-=\pm 15V, R_L=2k\Omega$ to $0V$



Open-Loop Voltage Gain vs. Temperature
 $R_L=2k\Omega$ to $0V, V^+/V^-=\pm 16V, V_o=-11V$ to $+11V$

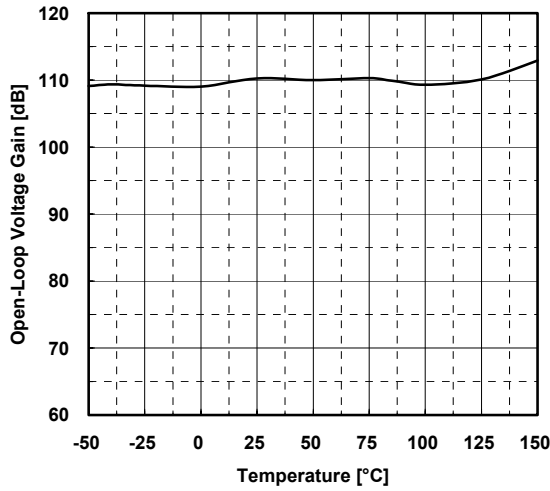


Open-Loop Voltage Gain vs. Temperature
 $R_L=2k\Omega$ to $0V, V^+/V^-=\pm 15V, V_o=-10V$ to $+10V$

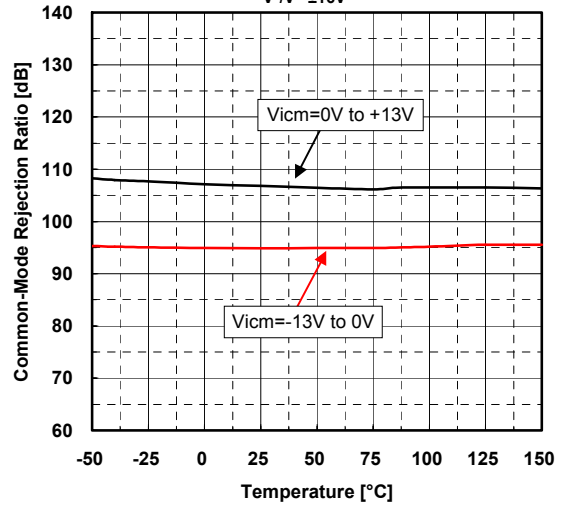


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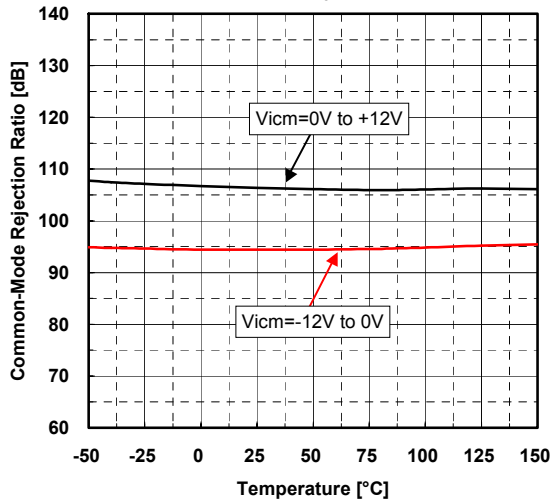
Open-Loop Voltage Gain vs. Temperature
 $R_L=2k\Omega$ to 0V, $V^+V^-=\pm 3.5V$, $V_o=-1V$ to +1V



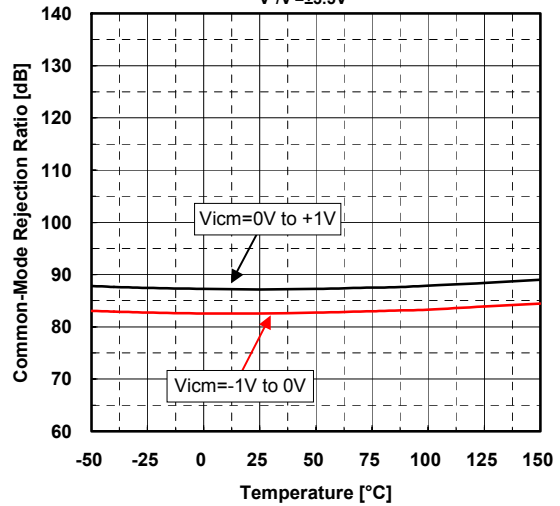
Common-Mode Rejection Ratio vs. Temperature
 (Input Common-Mode Voltage)
 $V^+V^-=\pm 16V$



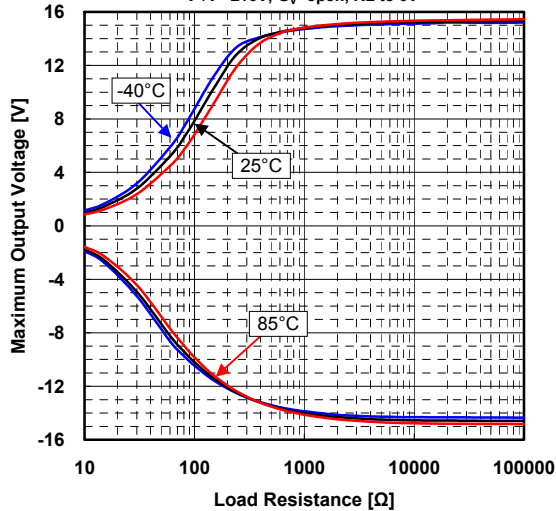
Common-Mode Rejection Ratio vs. Temperature
 (Input Common-Mode Voltage)
 $V^+V^-=\pm 15V$



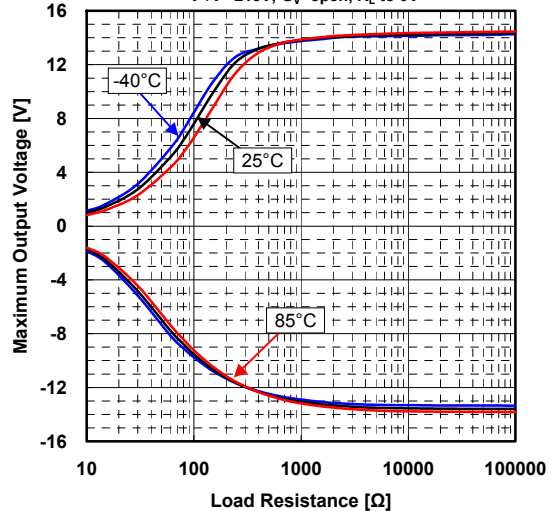
Common-Mode Rejection Ratio vs. Temperature
 (Input Common-Mode Voltage)
 $V^+V^-=\pm 3.5V$

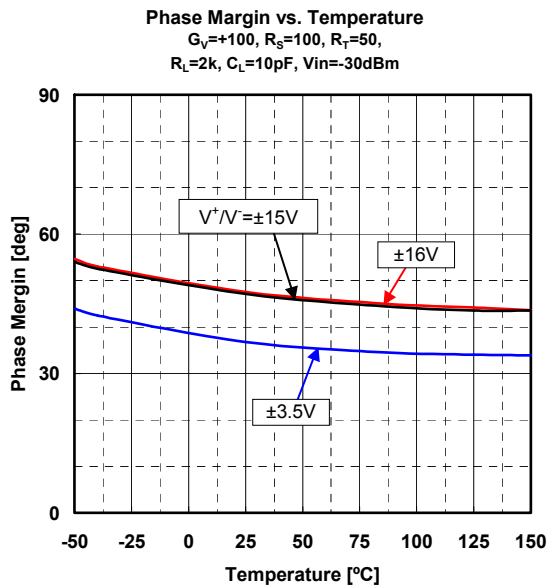
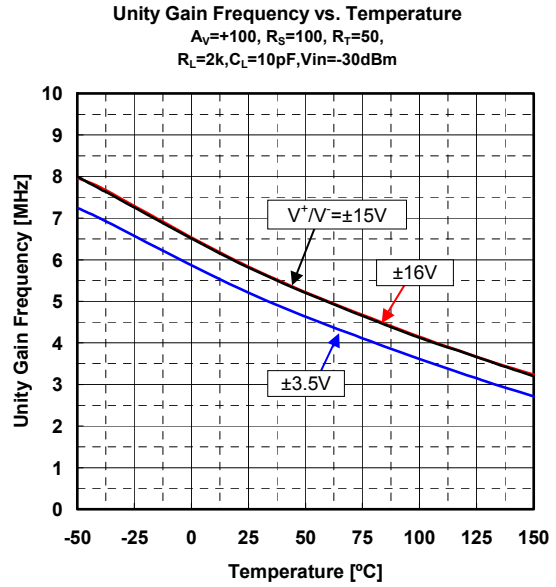
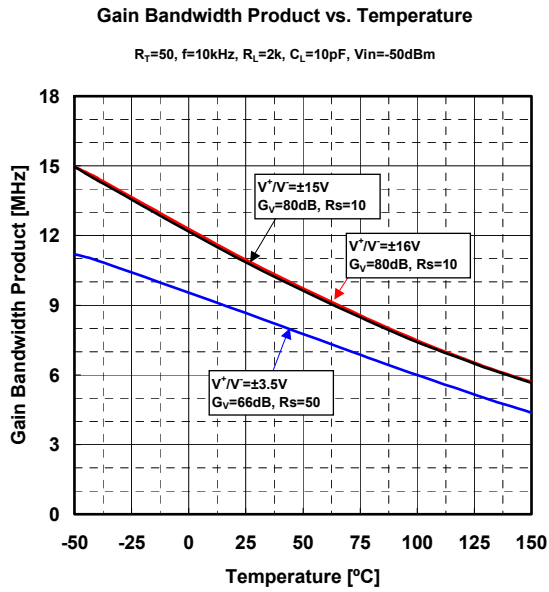
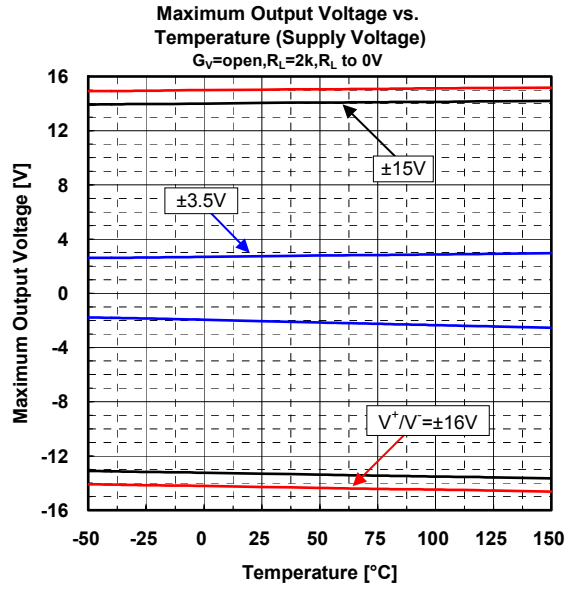
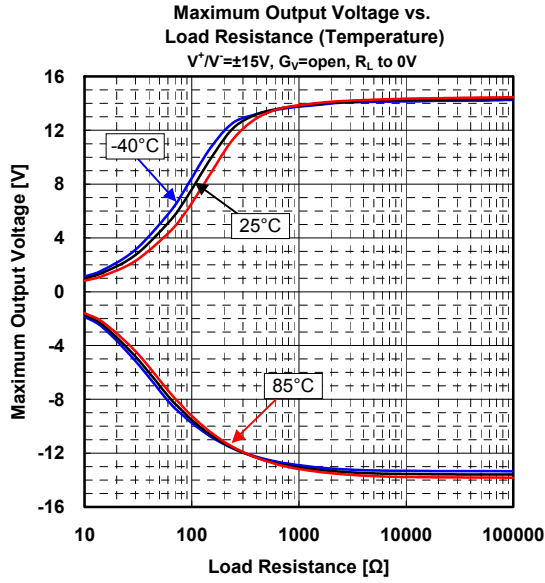


Maximum Output Voltage vs.
 Load Resistance (Temperature)
 $V^+V^-=\pm 16V$, $G_v=open$, R_L to 0V



Maximum Output Voltage vs.
 Load Resistance (Temperature)
 $V^+V^-=\pm 15V$, $G_v=open$, R_L to 0V





MUSES8820

MEMO

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