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

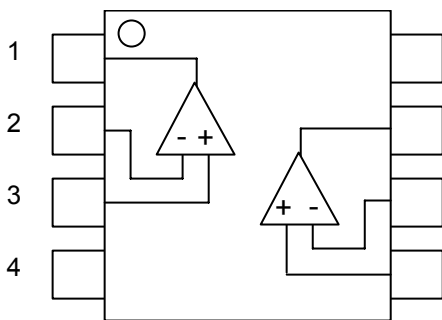
The **MUSES01** is a dual J-FET input high quality audio operational amplifier, which is optimized for high-end audio and professional audio applications with advanced circuitry and layout, unique material and assembled technology by skilled-craftwork.

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

■ FEATURES

- | | |
|-----------------------|----------------------------------|
| ●Operating Voltage | $V_{opr} = \pm 9V$ to $\pm 16V$ |
| ●Output noise | 9.5nV/ \sqrt{Hz} at f=1kHz |
| ●Input Offset Voltage | 0.8mV typ. 5mV max. |
| ●Input Bias Current | 200pA typ. 800pA max. at Ta=25°C |
| ●Voltage Gain | 105dB typ. |
| ●Slew Rate | 12V/ μs typ. |
| ●Bipolar Technology | |
| ●Package Outline | DIP8 |

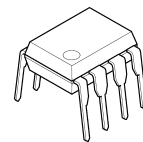
■ PIN CONFIGURATION



PIN FUNCTION

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

■ PACKAGE OUTLINE



MUSES01D



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MUSES01

■ 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	910	mW
Output Current	I _O	±25	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.

■ RECOMMENDED OPERATING CONDITION (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V ⁺ /V ⁻	-	±9	-	±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 =∞	-	8.5	12.0	mA
Input Offset Voltage	V _{IO}	R _s ≤10kΩ (Note2, 3)	-	0.8	5.0	mV
Input Bias Current	I _B	(Note2, 3)	-	200	800	pA
Input Offset Current	I _{IO}	(Note2, 3)	-	100	400	pA
Voltage Gain	A _V	R _L ≥2kΩ, V _o =±10V	90	105	-	dB
Common Mode Rejection Ratio	CMR	V _{ICM} =±8V (Note4)	60	75	-	dB
Supply Voltage Rejection Ratio	SVR	V ⁺ /V ⁻ =±9.0 to ±16.0V (Note2, 5)	70	83	-	dB
Max Output Voltage 1	V _{OM1}	R _L =10kΩ	±12	±13.5	-	V
Max Output Voltage 2	V _{OM2}	R _L =2kΩ	±10	±12.5	-	V
Input Common Mode Voltage Range	V _{ICM}	CMR≥60dB	±8	±9.5	-	V

(Note2) Measured at V_{ICM}=0V

(Note3) Written by the absolute rate.

(Note4) CMR is calculated by specified change in offset voltage. (V_{ICM}=0V to +8V and V_{ICM}=0V to -8V)

(Note5) SVR is calculated by specified change in offset voltage. (V⁺/V⁻=±9V to ±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	$f = 10kHz$	-	3.3	-	MHz
Unity Gain Frequency	f_T	$A_V = +100, R_S = 100\Omega,$ $R_L = 2k\Omega, C_L = 10pF$	-	3.0	-	MHz
Phase Margin	ϕ_M	$A_V = +100, R_S = 100\Omega,$ $R_L = 2k\Omega, C_L = 10pF$	-	60	-	deg
Input Noise Voltage1	V_{NI}	$f = 1kHz, A_V = +100,$ $R_S = 100\Omega$	-	9.5	-	nV/ \sqrt{Hz}
Input Noise Voltage2	V_{N2}	RIAA, $R_S = 2.2k\Omega,$ 30kHz LPF	-	1.2	3.0	μV_{rms}
Total Harmonic Distortion	THD	$f = 1kHz, A_V = +10,$ $R_L = 2k\Omega, V_o = 5V_{rms}$	-	0.002	-	%
Channel Separation	CS	$f = 1kHz, A_V = +100, R_S = 1k\Omega,$ $R_L = 2k\Omega$	-	150	-	dB
Positive Slew Rate	+SR	$A_V = 1, V_{IN} = 2V_{p-p},$ $R_L = 2k\Omega, C_L = 10pF$	-	12	-	V/ μs
Negative Slew Rate	-SR	$A_V = 1, V_{IN} = 2V_{p-p},$ $R_L = 2k\Omega, C_L = 10pF$	-	13	-	V/ μs

MUSES01

■ 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 MUSES01 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 MUSES01 is obtained using following equation.

$$(\text{Actual Dissipation Power}) = (\text{Supply Voltage } V_{DD}) \times (\text{Supply Current } I_{DD}) - (\text{Output Power } P_o)$$

The MUSES01 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.

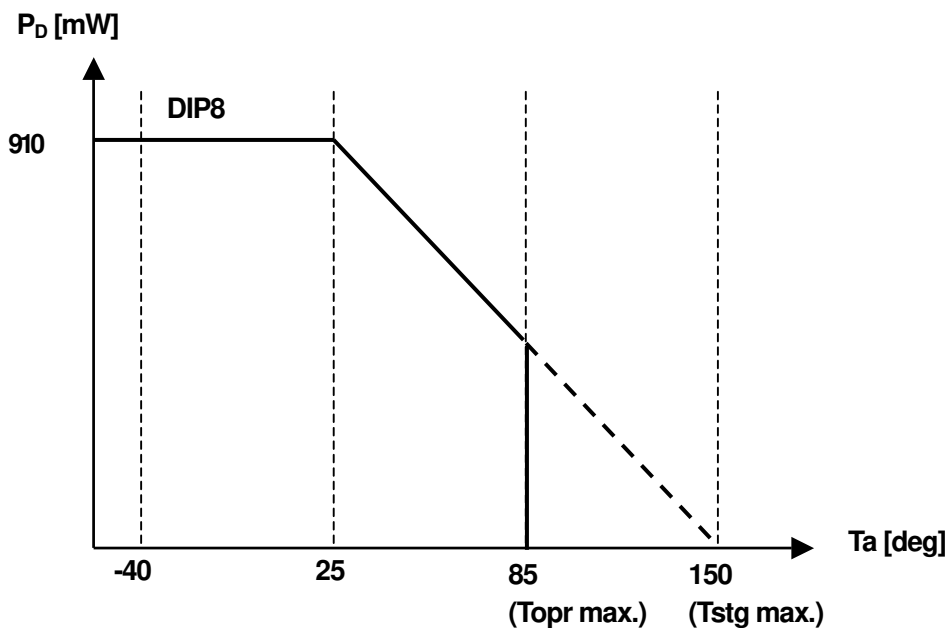
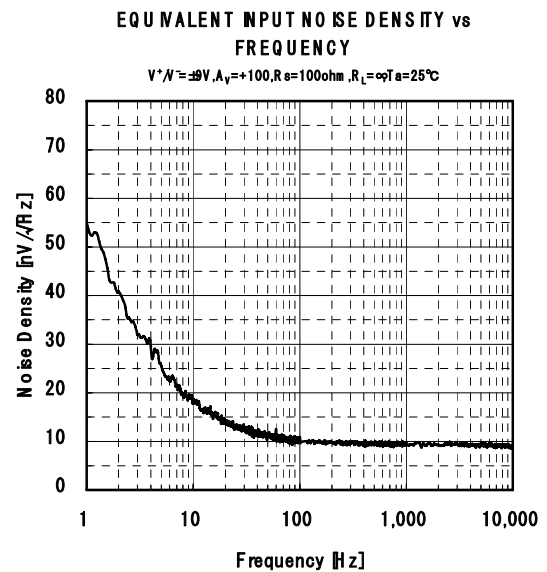
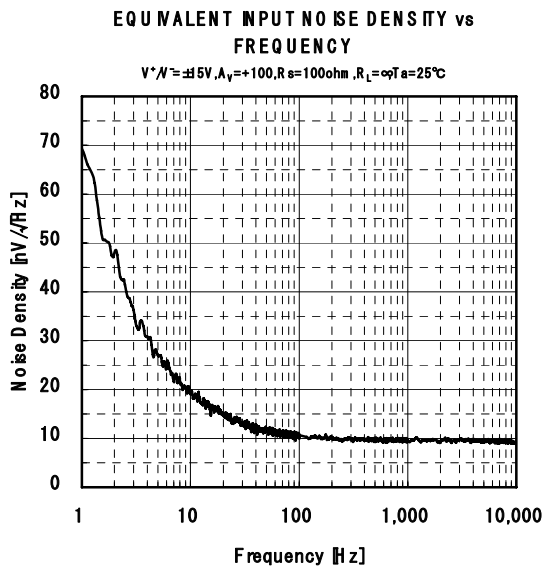
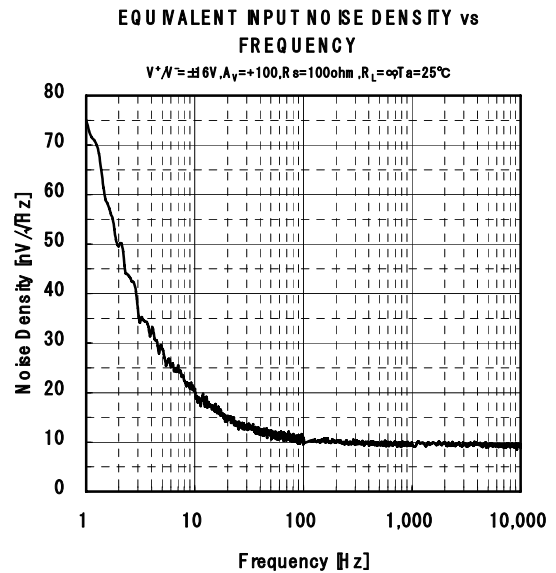
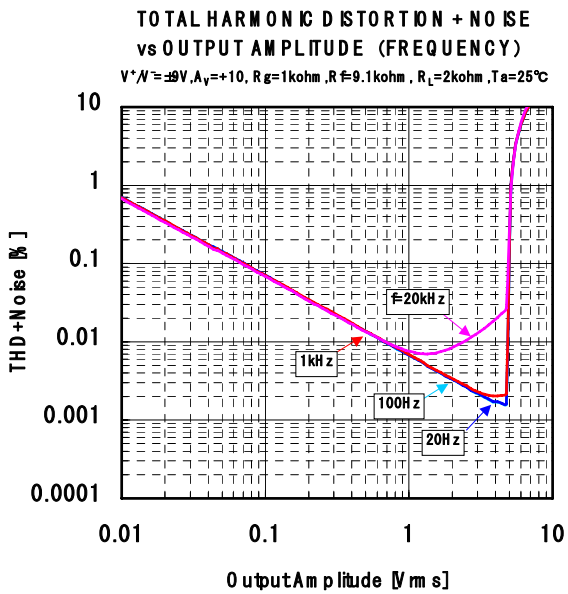
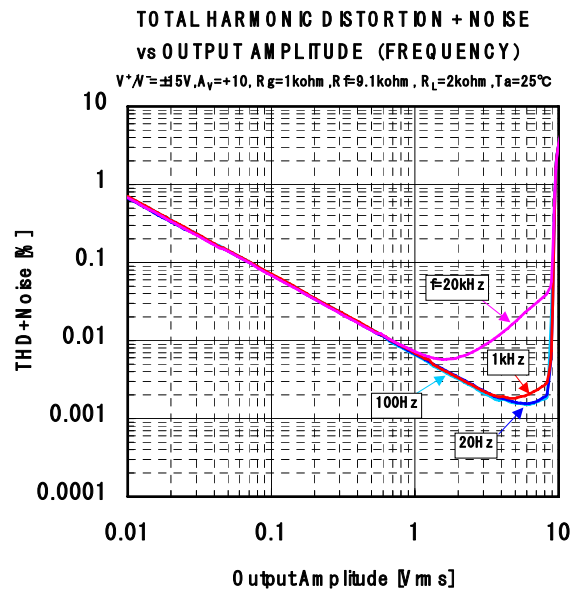
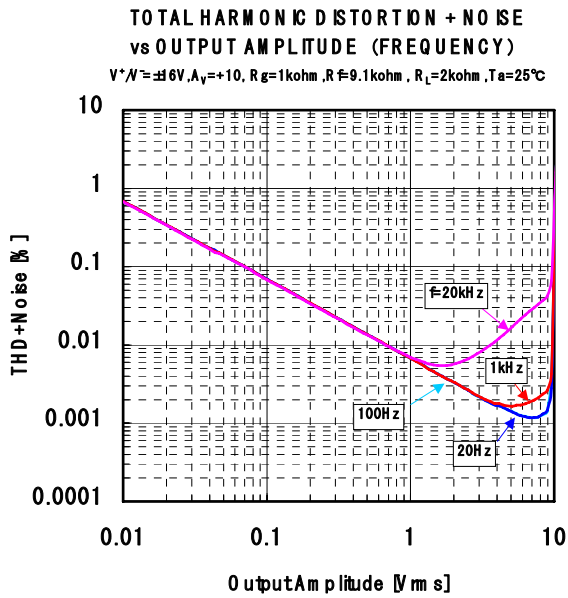
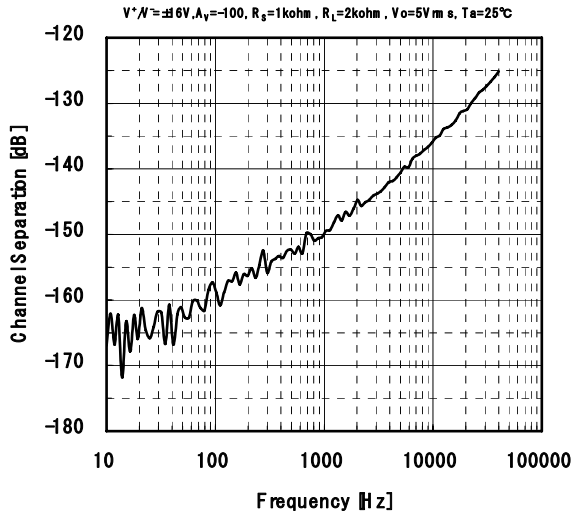


Fig.1 Power Dissipations vs. Ambient Temperature on the MUSES01

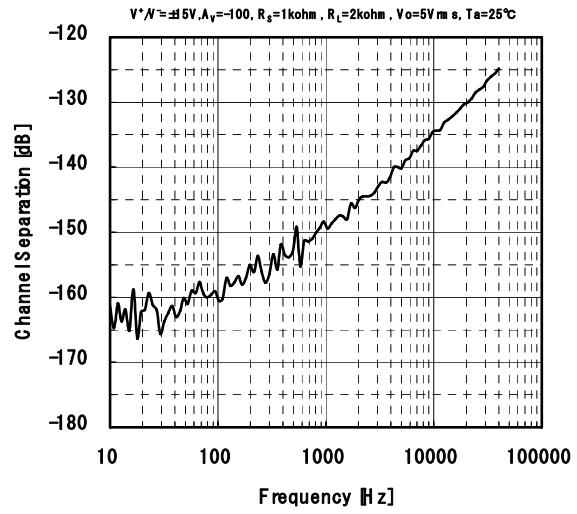
■ TYPICAL CHARACTERISTICS



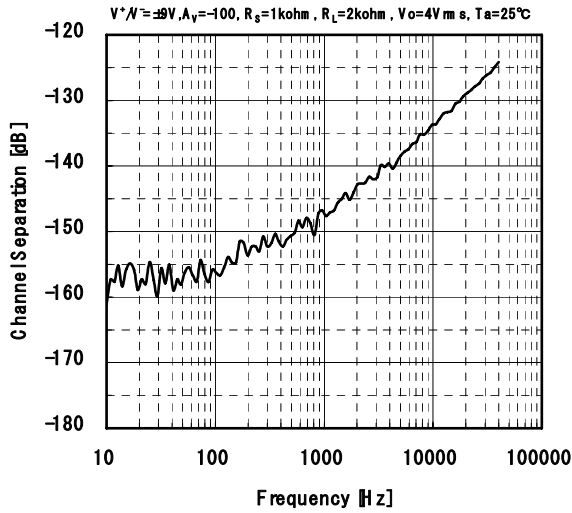
CHANNEL SEPARATION vs FREQUENCY



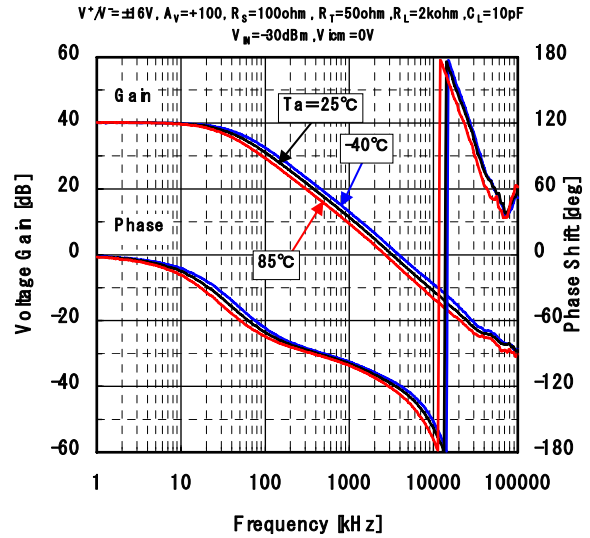
CHANNEL SEPARATION vs FREQUENCY



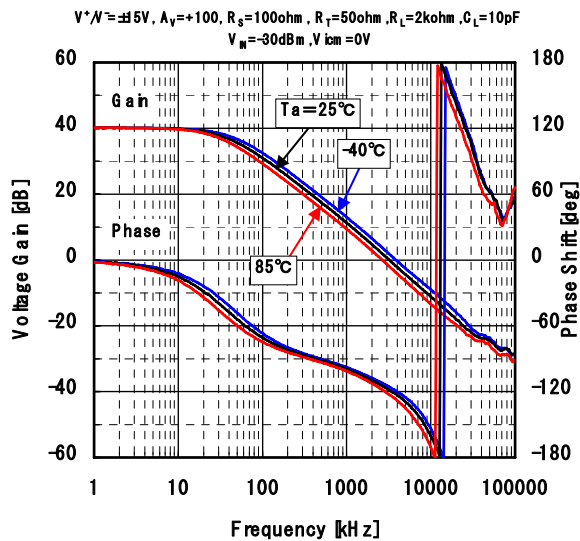
CHANNEL SEPARATION vs FREQUENCY



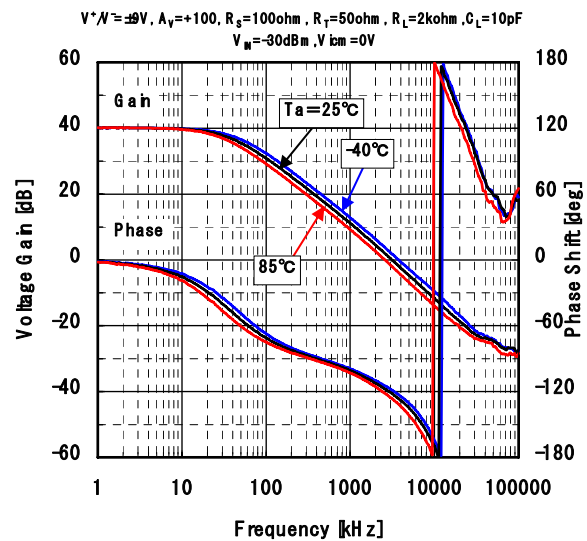
CLOSED-LOOP GAIN/PHASE vs FREQUENCY (TEMPERATURE)



CLOSED-LOOP GAIN/PHASE vs FREQUENCY (TEMPERATURE)

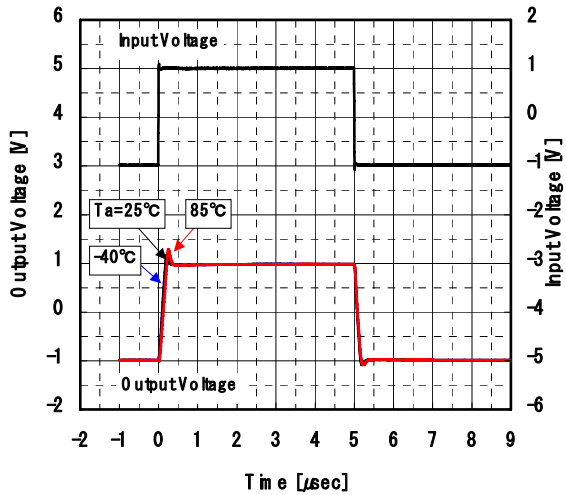


CLOSED LOOP GAIN/PHASE vs FREQUENCY (TEMPERATURE)



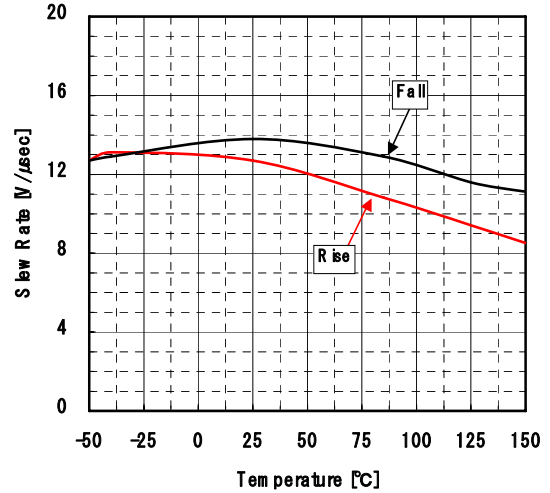
TRANSIENT RESPONSE (TEMPERATURE)

$V^*N = \pm 6V, V_M = 2V_{p-p}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10pF, R_L = 2k\Omega$



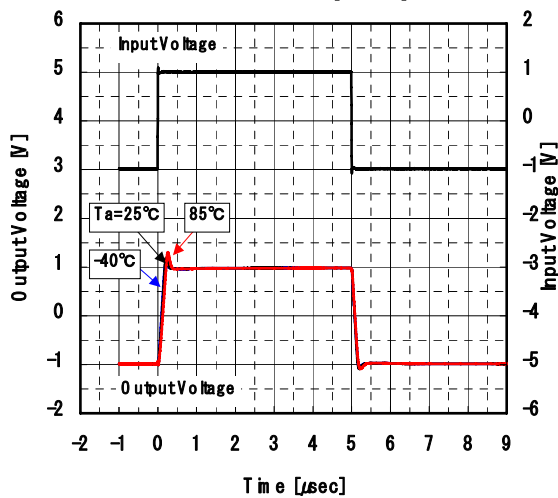
SLEW RATE vs TEMPERATURE

$V^*N = \pm 6V, V_M = 2V_{p-p}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10pF, R_L = 2k\Omega$



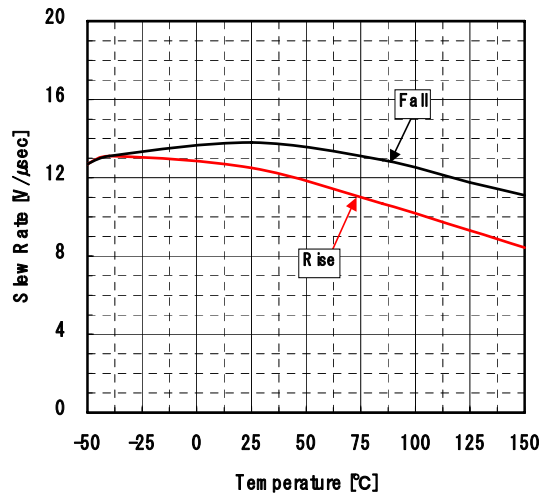
TRANSIENT RESPONSE (TEMPERATURE)

$V^*N = \pm 5V, V_M = 2V_{p-p}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10pF, R_L = 2k\Omega$



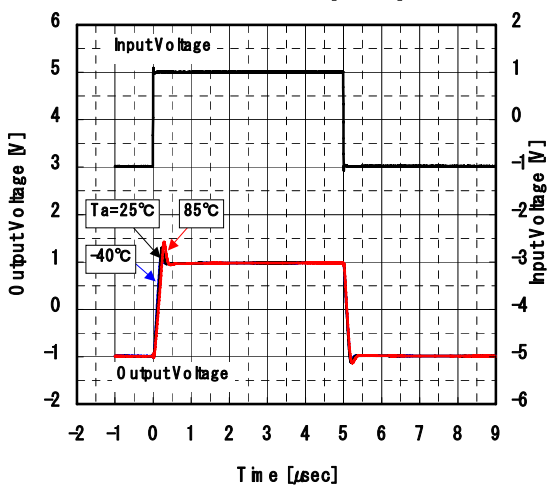
SLEW RATE vs TEMPERATURE

$V^*N = \pm 5V, V_M = 2V_{p-p}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10pF, R_L = 2k\Omega$



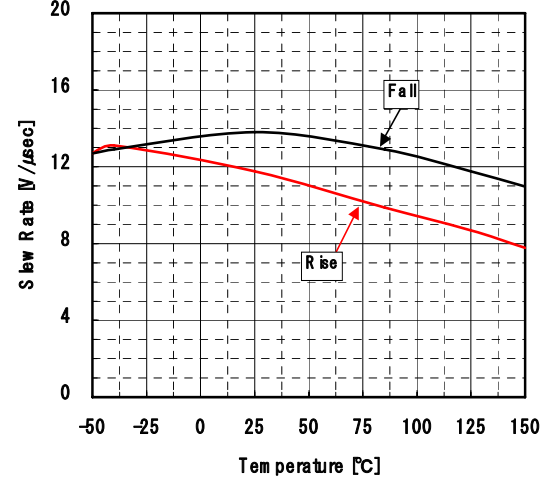
TRANSIENT RESPONSE (TEMPERATURE)

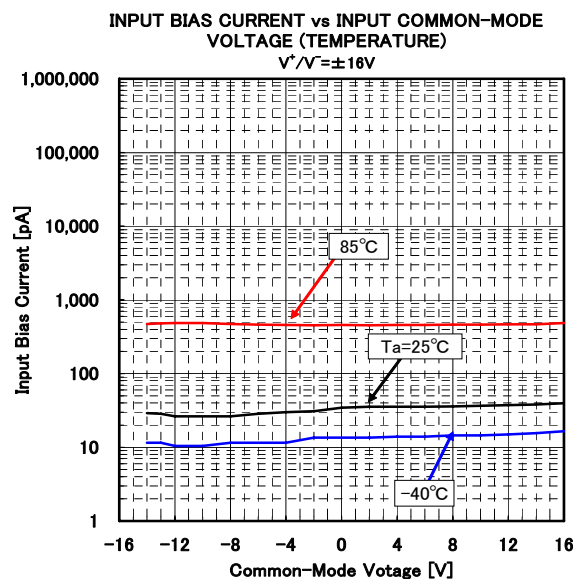
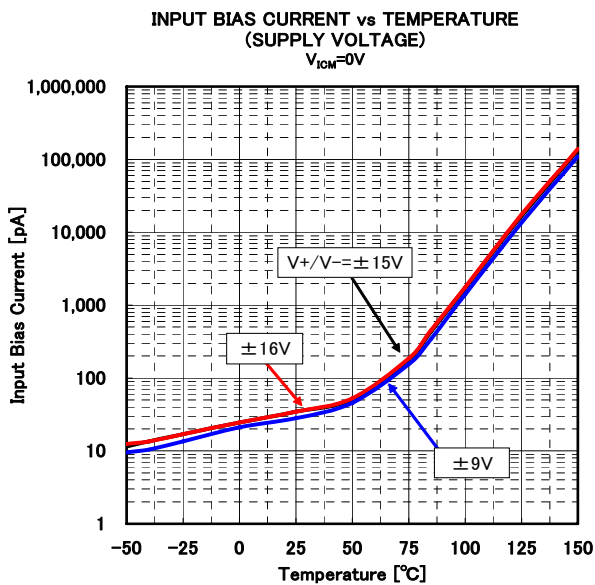
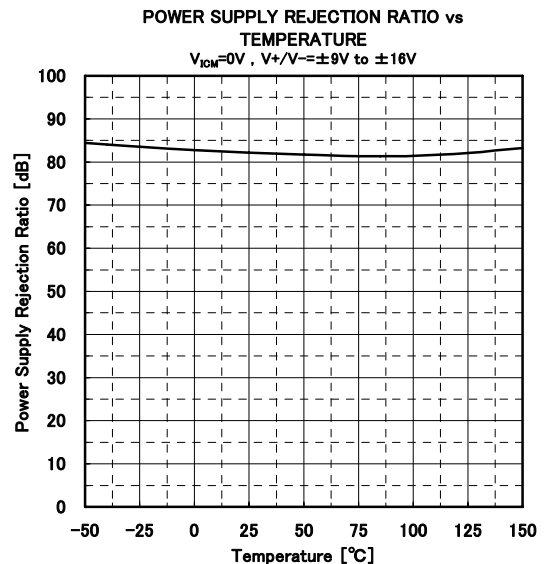
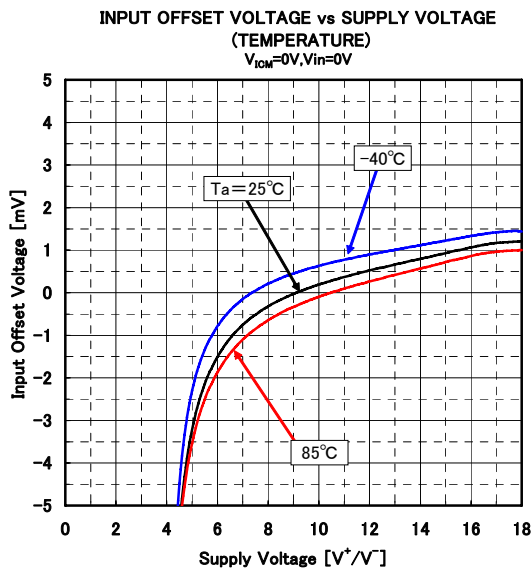
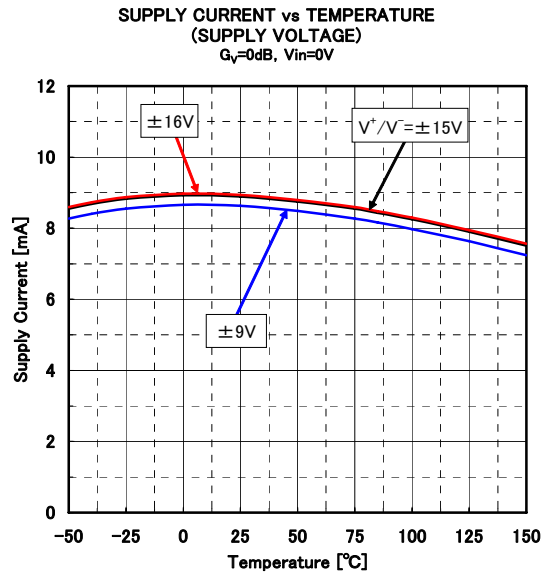
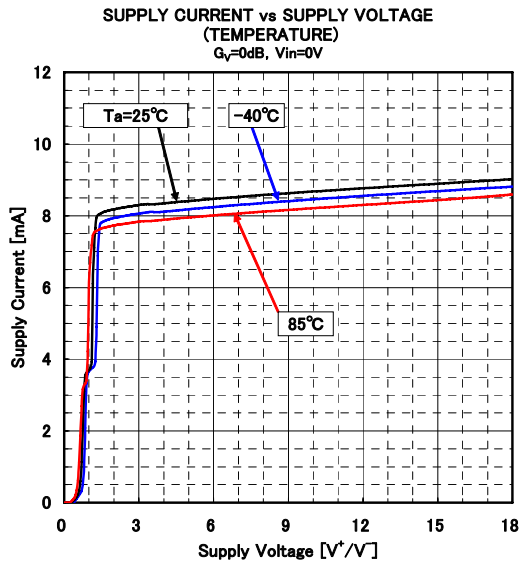
$V^*N = \pm 9V, V_M = 2V_{p-p}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10pF, R_L = 2k\Omega$



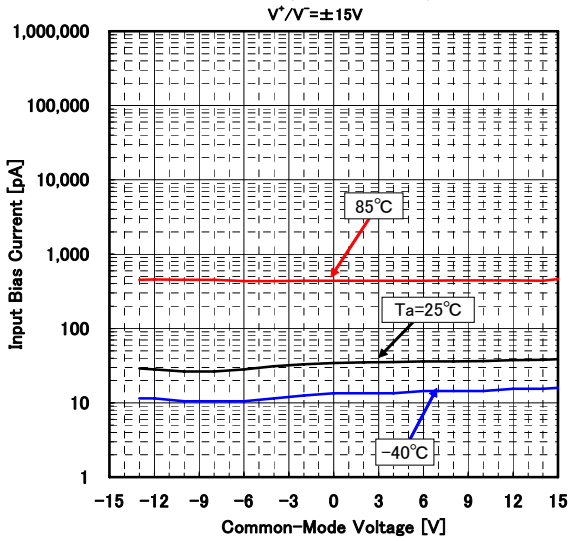
SLEW RATE vs TEMPERATURE

$V^*N = \pm 9V, V_M = 2V_{p-p}, f = 100kHz$
 PulseEdge=10nsec, Gv=0dB, $C_L = 10pF, R_L = 2k\Omega$

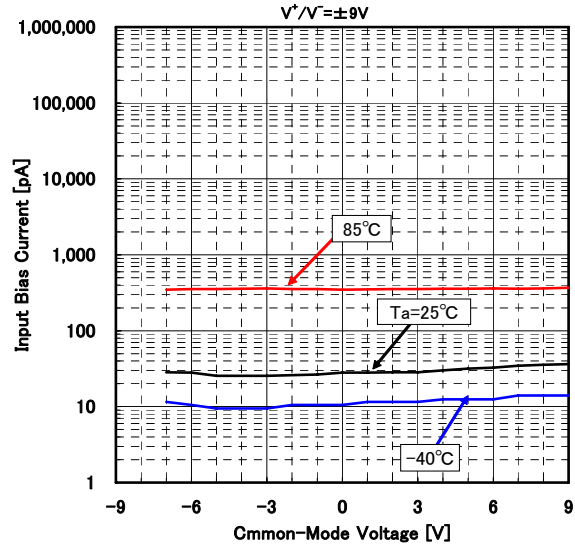




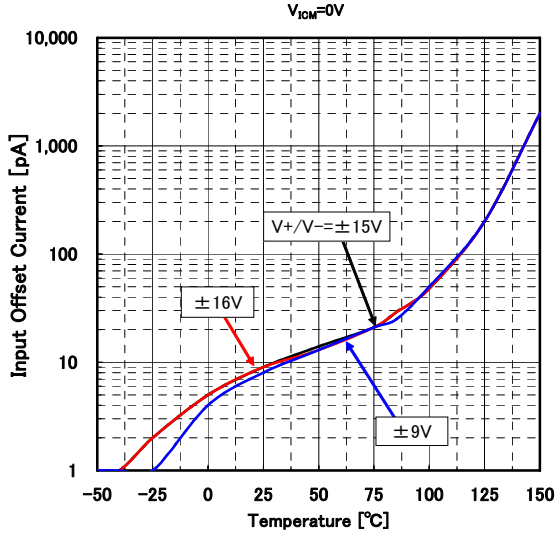
INPUT BIAS CURRENT vs INPUT COMMON-MODE VOLTAGE (TEMPERATURE)



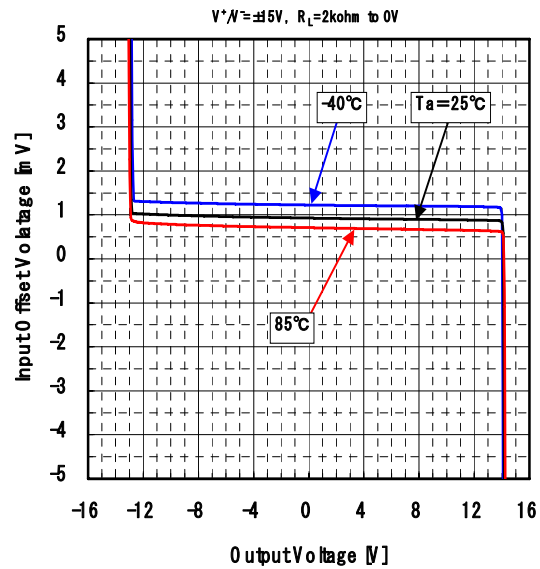
INPUT BIAS CURRENT vs INPUT COMMON-MODE VOLTAGE (TEMPERATURE)



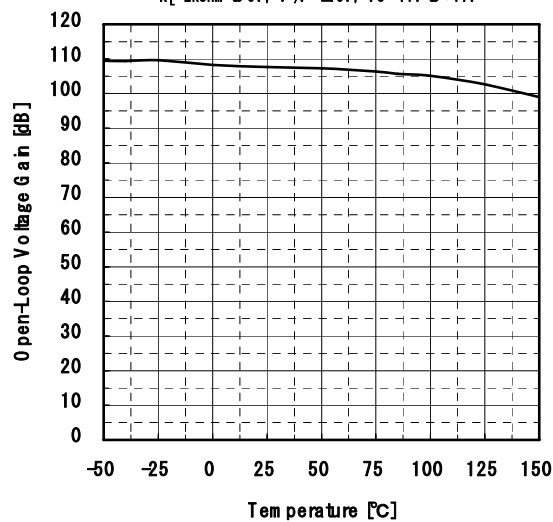
INPUT OFFSET CURRENT vs TEMPERATURE (SUPPLY VOLTAGE)



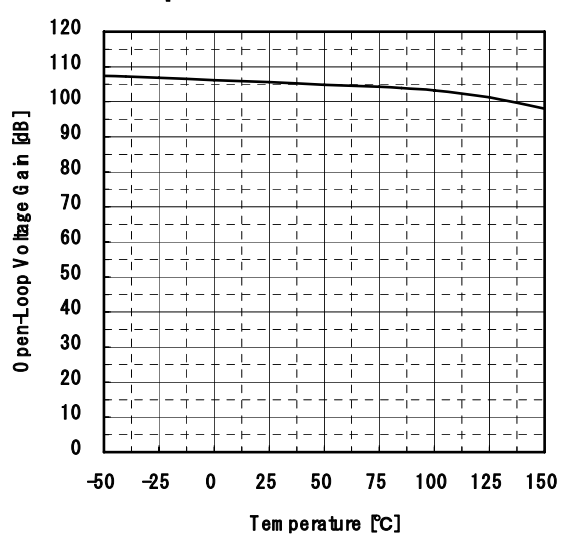
INPUT OFFSET VOLTAGE vs OUTPUT VOLTAGE (TEMPERATURE)



OPEN-LOOP VOLTAGE GAIN vs TEMPERATURE

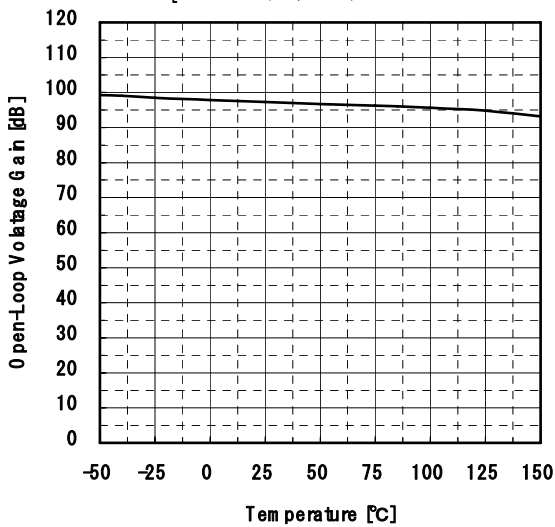


OPEN-LOOP VOLTAGE GAIN vs TEMPERATURE



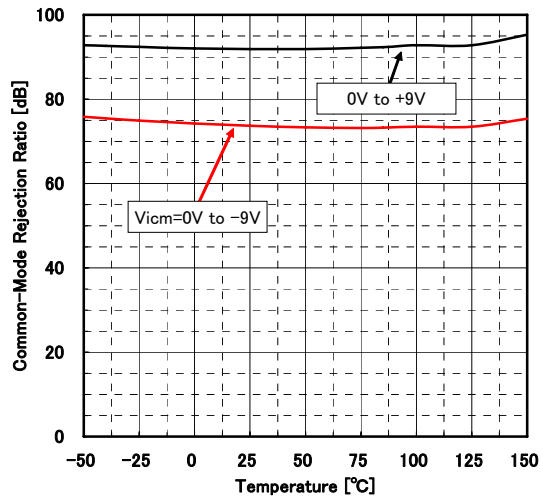
OPEN-LOOP VOLTAGE GAIN vs TEMPERATURE

$R_L = 2\text{k}\Omega$ to $0V$, $V^*/V = \pm 9V$, $V_o = -4V$ to $+4V$



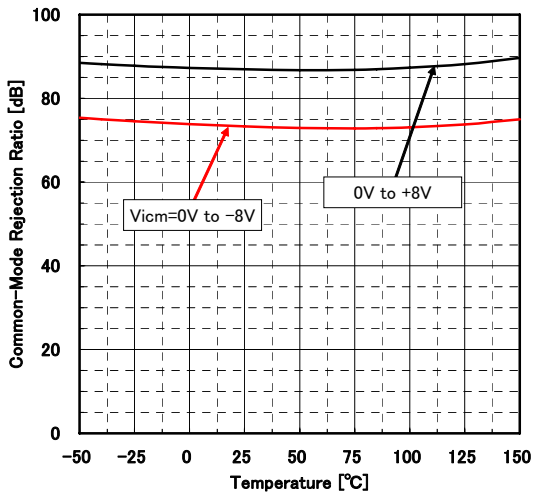
COMMON-MODE REJECTION RATIO vs TEMPERATURE (INPUT COMMON-MODE VOLTAGE)

$V^*/V = \pm 16V$



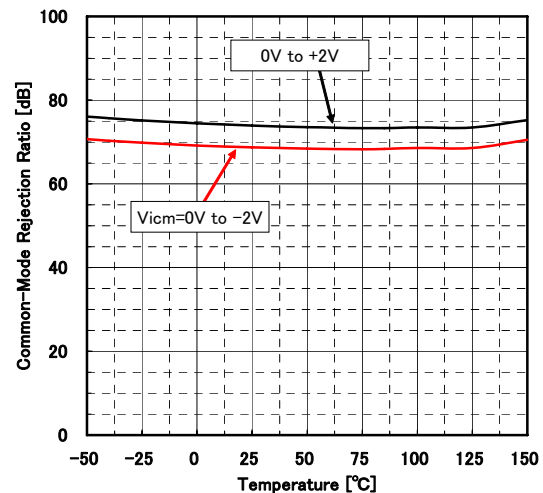
COMMON-MODE REJECTION RATIO vs TEMPERATURE (INPUT COMMON-MODE VOLTAGE)

$V^*/V = \pm 15V$



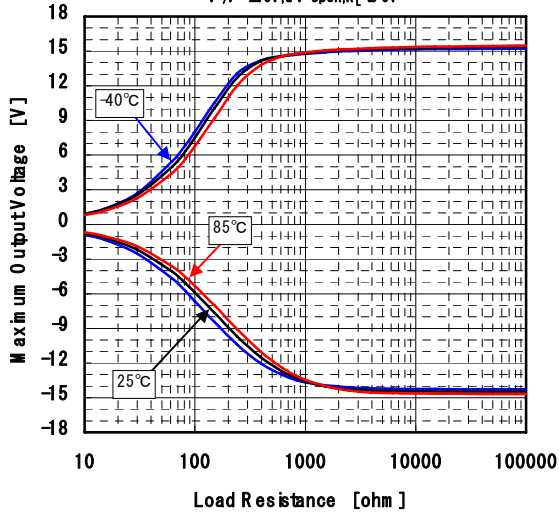
COMMON-MODE REJECTION RATIO vs TEMPERATURE (INPUT COMMON-MODE VOLTAGE)

$V^*/V = \pm 9V$



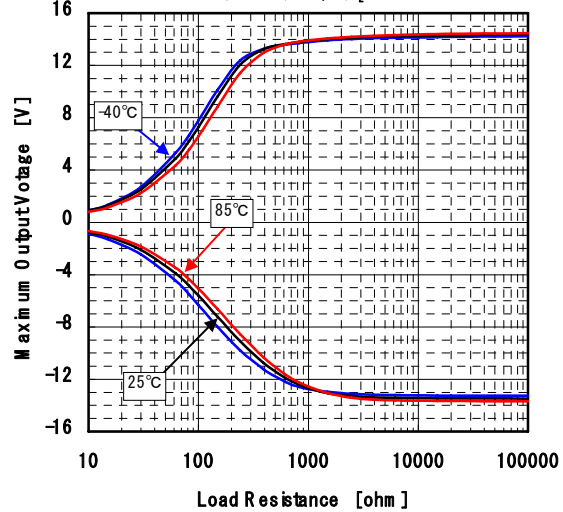
MAXIMUM OUTPUT VOLTAGE vs LOAD RESISTANCE (TEMPERATURE)

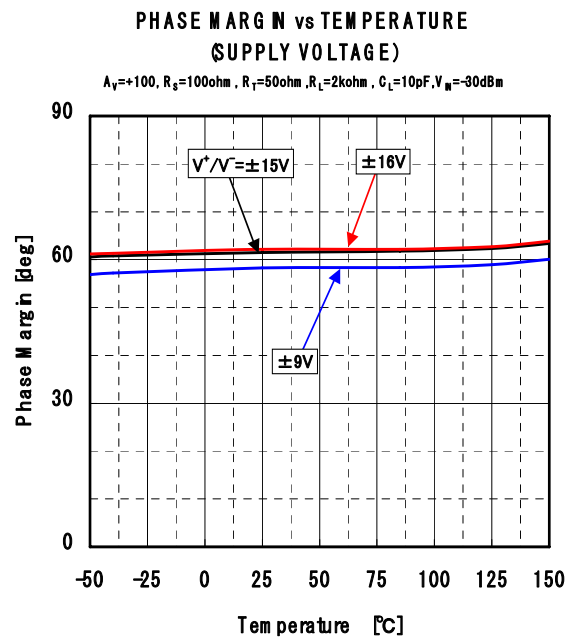
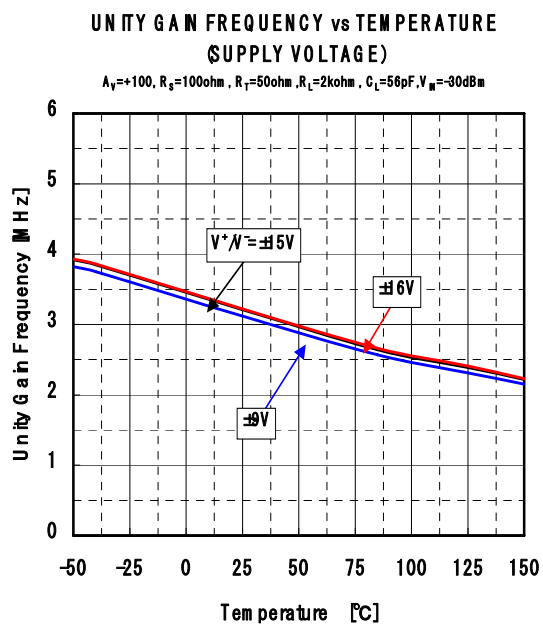
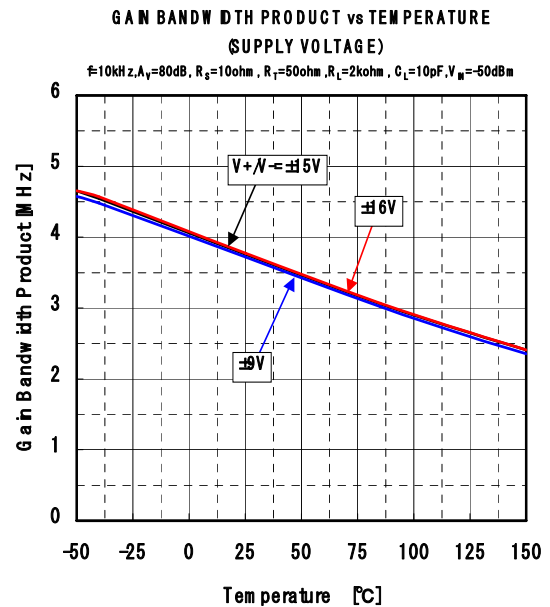
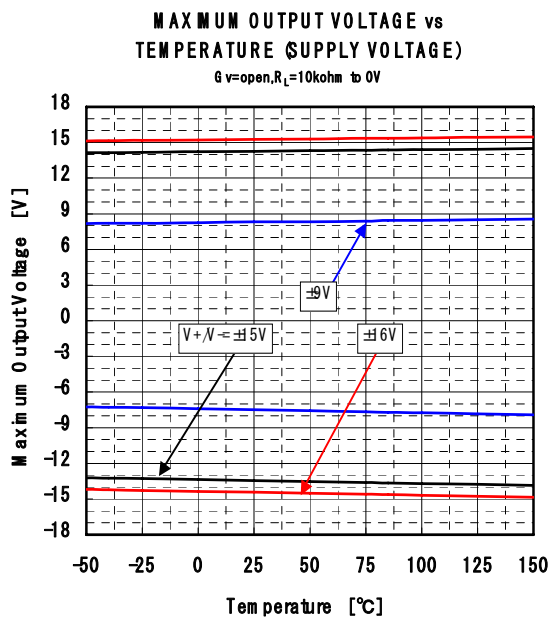
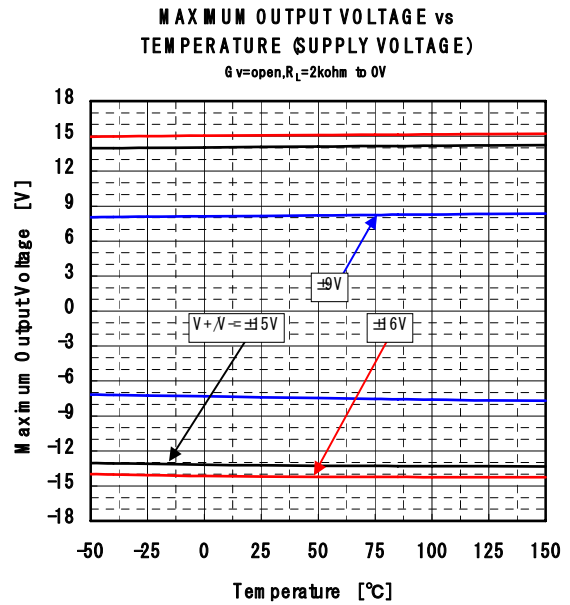
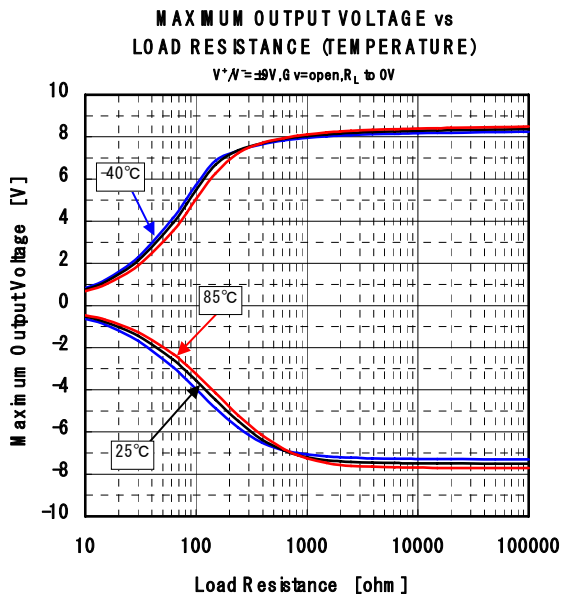
$V^*/V = \pm 6V$, $v = \text{open}$, R_L to $0V$



MAXIMUM OUTPUT VOLTAGE vs LOAD RESISTANCE (TEMPERATURE)

$V^*/V = \pm 5V$, $v = \text{open}$, R_L to $0V$





MEMO

[CAUTION]

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