LOW-NOISE DUAL OPERATIONAL AMPLIFIER

■ GENERAL DESCRIPTION

The NJM5532C is a high performance dual low noise operational amplifier. This features low noise performance (5nV/√Hz), and considerably higher Gain Band Width (10MHz), low distortion (0.0003%). This makes the device especially suitable for application in high quality and professional audio.

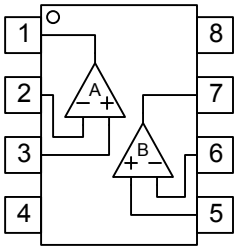
■ PACKAGE OUTLINE

NJM5532CG
(SOP8)

■ FEATURES

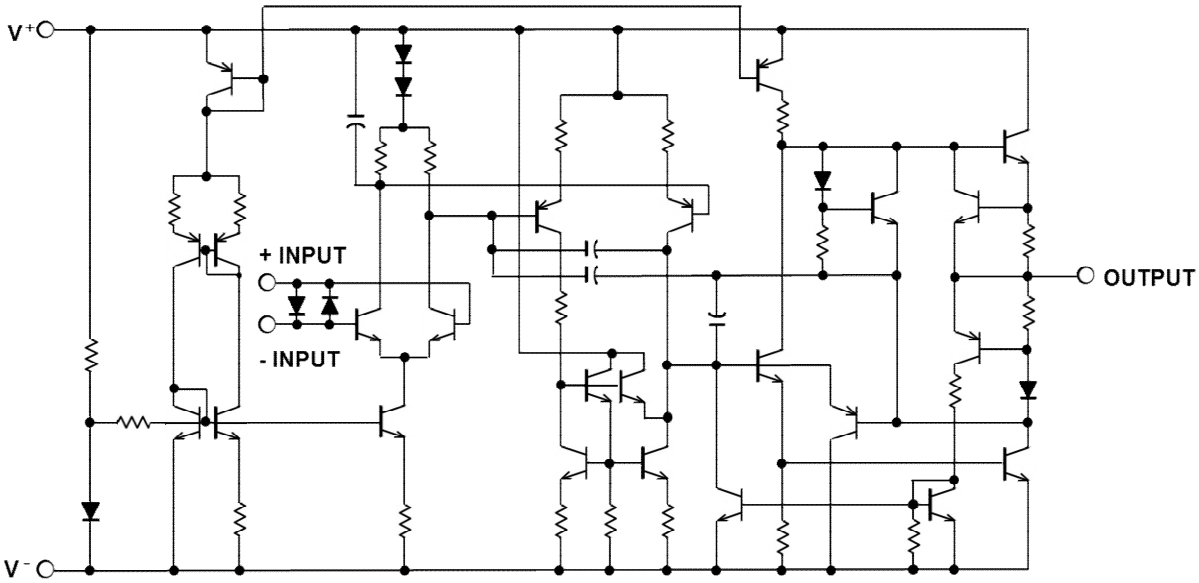
- Equivalent Input Noise Voltage : 5nV/√Hz typ. at 1kHz
- Gain bandwidth product : 10MHz typ.
- Common-Mode Rejection Ratio : 100dB typ.
- High DC Voltage Gain : 94dB typ.
- High Slew Rate : 9V/us typ.
- Wide power supply range : ±3V to ±22V
- Internal ESD protection
  Human body model (HBM) : ±2000V typ.

■ 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^+

■ EQUIVALENT CIRCUIT (Each Amplifier)



■ ABSOLUTE MAXIMUM RATINGS (Ta=25˚C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply voltage	V^+/V^-	±22	V
Input voltage (1)	V_{IN}	V^--0.3 to V^-+44	V
Output terminal input voltage	V_O	V^--0.3 to V^++0.3	V
Differential input voltage(2)	V_{ID}	±0.5	V
Input current (3)	I_{IN}	±10	mA
Output short-circuit duration (4)		Infinite	-
Power Dissipation	P_D	690 (5) 1000 (6)	mW
Operating free-air temperature range	T_{opr}	-40 to 85	°C
Storage temperature range	T_{stg}	-65 to +150	°C

(1) Input voltage is the voltage should be allowed to apply to the input terminal independent of the magnitude of V+.
The normal operation will establish when any input is within the Common Mode Input Voltage Range of electrical characteristics.
(2) Differential voltage is the voltage difference between +INPUT and -INPUT.
(3) Excessive input current will flow if a differential input voltage in excess of approximately 0.5 V is applied between the inputs, unless some limiting resistance is used.
(4) The output may be shorted to ground or either power supply. Temperature and/or supply voltages must be limited to ensure the maximum dissipation rating is not exceeded.
(5) EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 2layers, FR-4) mounting
(6) EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 4layers, FR-4) mounting

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V^+/V^-	Ta=25ºC	±3	-	±22	V

■ ELECTRICAL CHARACTERISTICS

V^+/V^-=±15V, Ta=25˚C (unless otherwise noted)

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V_{IO}	R_S=50Ω Ta=25˚C 0˚C<Ta< 70˚C(7)	- -	0.5 -	4 5	mV
Input Offset Current	I_{IO}	Ta=25˚C 0˚C<Ta< 70˚C(7)	-	10	150 200	nA
Input Bias Current	I_B	Ta=25˚C 0˚C<Ta< 70˚C(7)	- -	200 -	800 1000	nA
OpenLoop Gain 1	A_{v1}	R_L≥600Ω, Vo=±10V Ta=25˚C 0˚C<Ta< 70˚C (7)	83.5 80	94 -	- -	dB
Open Loop Gain 2	A_{v2}	R_L≥2kΩ, Vo= ±10V Ta=25˚C 0˚C<Ta< 70˚C(7)	88 83.5	100 -	- -	dB
Supply Voltage Rejection Ratio	SVR	Rs≤10kΩ,V^+/V^- = ±9V to ±15V	80	100	-	dB
Supply Current, all amp	I_{CC}	no load	-	8	16	mA
Common mode Input Voltage Range	V_{ICM}		±12	±13	-	V
Common Mode Rejection Ratio	CMR	R_S ≤10kΩ	70	100	-	dB
Short-circuit Output Currrent (8)	I_{SC}		20	50	75	mA

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Maximum Output Voltage	V_{OM}	R_L ≥600Ω R_L ≥600Ω, V^+/V^- = ±18V	±12 ±15	±13 ±16	-	V
Input Resistance	R_{IN}		30	150	-	kΩ
Output Resistance	Ro		-	0.3	-	Ω
Small-signal Voltage Gain	A_V	f=10kHz	-	67	-	dB
Gain Band Width Product	GBP	R_L = 600Ω, C_L = 100pF	-	10	-	MHz
Powerband Width	W_{PG}	R_L = 600Ω, Vo= ±10V R_L = 600Ω, Vo= ±14V, V^+/V^- = ±18V	-	140 100	-	kHz
Equivalent Input Noise Voltage1	e_n	f=30Hz f=1kHz	-	8 5	-	nV/√Hz
Equivalent Input noise Current	I_n	f=30Hz f=1kHz	-	2.7 0.7	-	pA√Hz
Equivalent Input Noise Voltage2	V_{NI}	f=20 to 20kHz	-	0.6	0.8	μVrms
Slew Rate	SR		-	9	-	V/us
Overshoot factor	K_{OV}	G_V=1,V_{IN}=100mV_{PP},C_L=100pF,R_L=600Ω	-	10	-	%
Channel Separation	CS	f=1kHz	-	110	-	dB

(7) This parameter is not 100% test.
(8) Temperature and /or supply voltages must be limited to ensure the maximum dissipation rating is not exceeded.

■ APPLICATION INFORMATION

• **Back-to-back Diode Protection**

The input terminals of the NJM5532C are protected from excessive differential voltage by back-to-back diodes. However, When used in voltage follower circuit, the back-to-back diode may break at power on. Therefore, put a current-limiting resistance to input terminal as shown Fig.1.

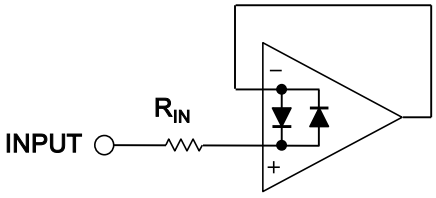
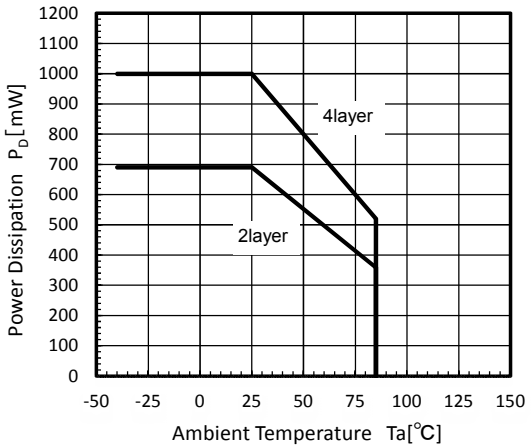


Fig.1

• **Caution to Thermal Design**

If the NJM5532C junction temperature (Tj) exceeds guaranteed value (150 degree) and the package power dissipation (P_D), there is possibility of the NJM5532C deterioration or breakdown.
The NJM5532C supply current is higher (I_{CCMAX}=16mA at V^+/V^- =±15V,Ta=+25˚C) and has positive temperature coefficient (Refer to Supply Current vs. Temperature characteristic).
Therefore, you should carefully design with due attention to the supply voltage, the internal power dissipation and the ambient temperature.



•Countermeasure to Excess Current by Parasitic Circuit

When the NJM5532C V+ is open (Fig.2), the NJM5532C may be burnt flowing the excess current by internal parasitic circuit(Fig.3).The excess current generating condition is following:

/ Between input terminal and V- voltage difference is higher.

/ Between input terminal and GND impedance is small.

/ V+ terminal is connected with low impedance. (Ietc is higher)

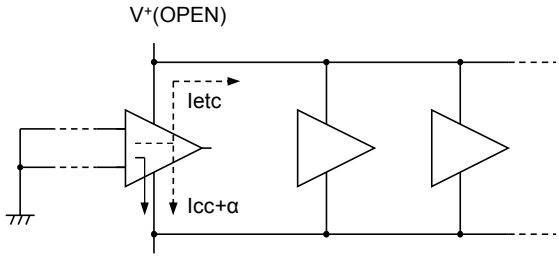


Fig.2

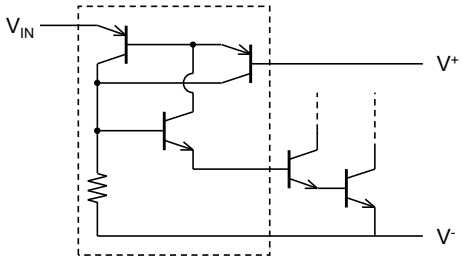


Fig.3

For countermeasure to excess current by parasitic circuit, NJRC recommends the following method.

/ prevent operating of a parasitic circuit by inserting a diode (Fig.4-1/4-2).

/ limiting a parasitic circuit operation by inserting a resistance (1kΩor more) (Fig.5).

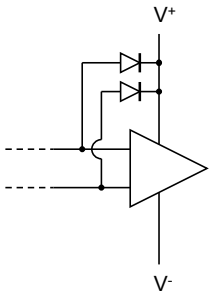


Fig.4-1

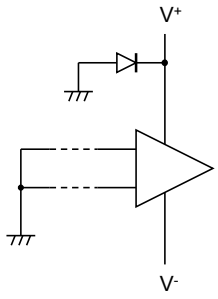


Fig.4-2

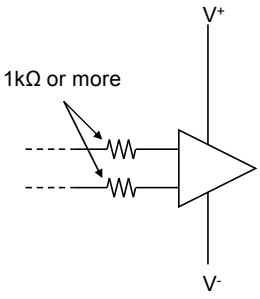
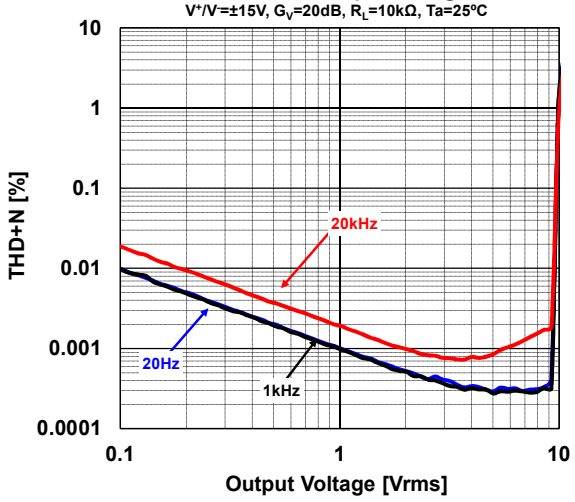


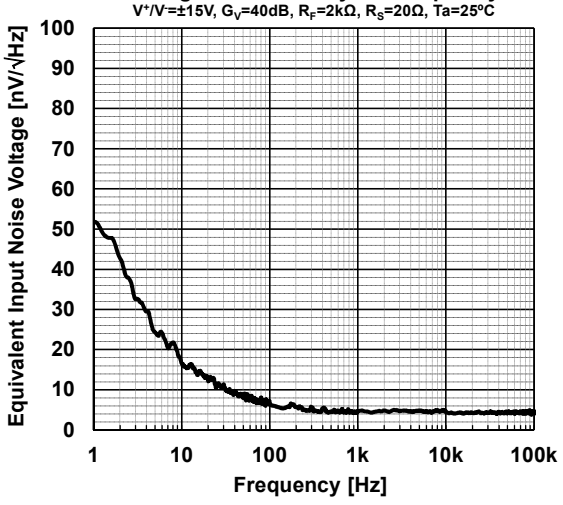
Fig.5

■ TYPICAL CHARACTERISTICS

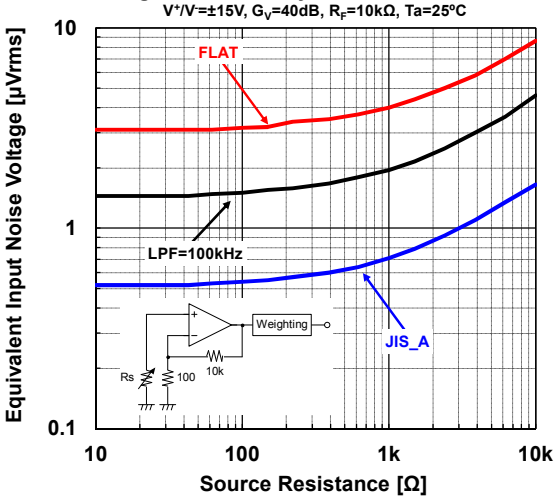
THD+N vs. Output Voltage
V⁺/V⁻=±15V, G_V=20dB, R_L=10kΩ, Ta=25°C



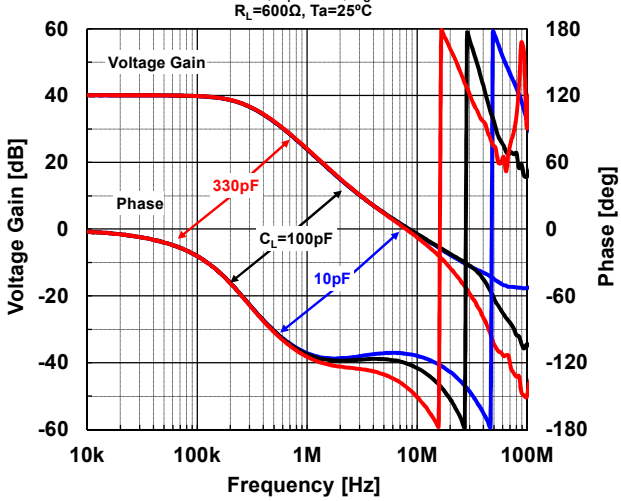
Voltage Noise Density vs. Frequency
V⁺/V⁻=±15V, G_V=40dB, R_F=2kΩ, R_S=20Ω, Ta=25°C



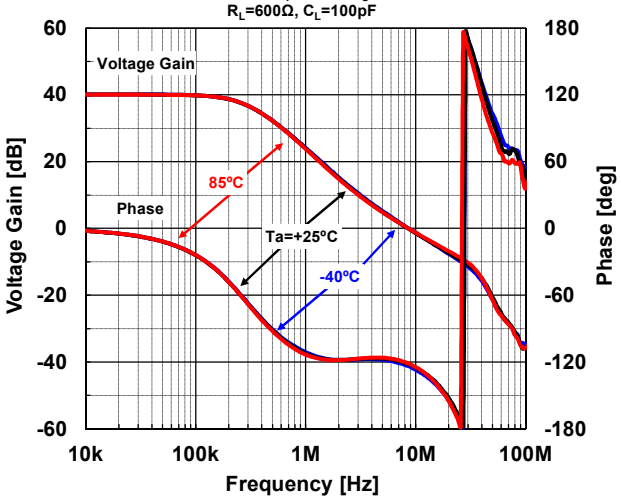
Voltage Noise Density vs. Source Resistance
V⁺/V⁻=±15V, G_V=40dB, R_F=10kΩ, Ta=25°C



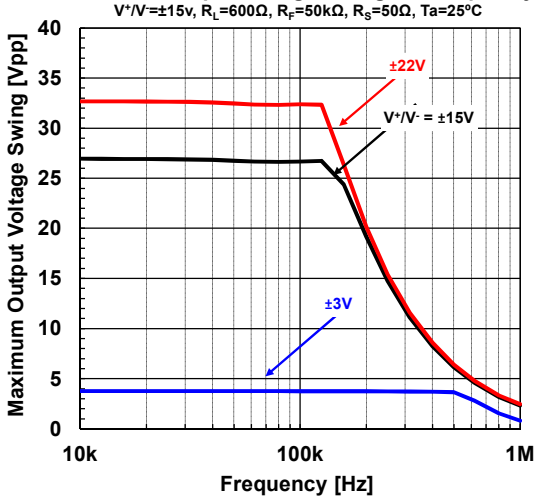
Voltage Gain vs. Frequency
V⁺/V⁻=±15V, R_F=50kΩ, R_S=500Ω
R_L=600Ω, Ta=25°C



Voltage Gain vs. Frequency
V⁺/V⁻=±15V, R_F=50kΩ, R_S=500Ω
R_L=600Ω, C_L=100pF

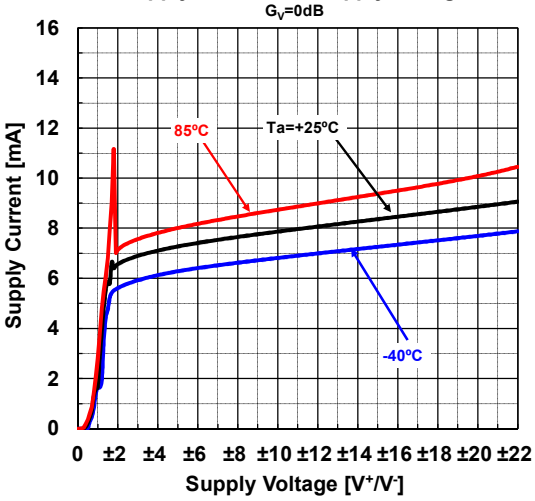


Maximum Output Voltage Swing vs. Frequency
V⁺/V⁻=±15v, R_L=600Ω, R_F=50kΩ, R_S=50Ω, Ta=25°C

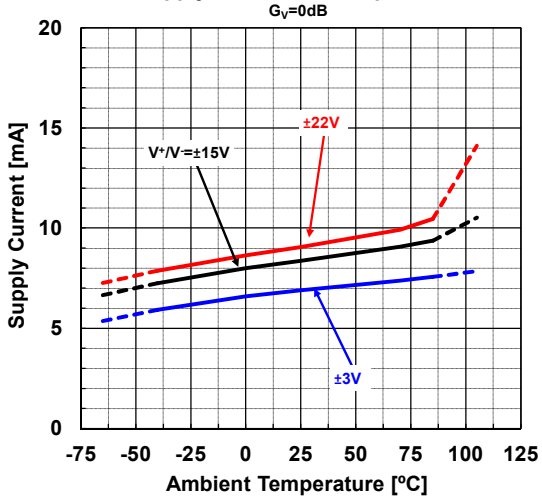


■ TYPICAL CHARACTERISTICS

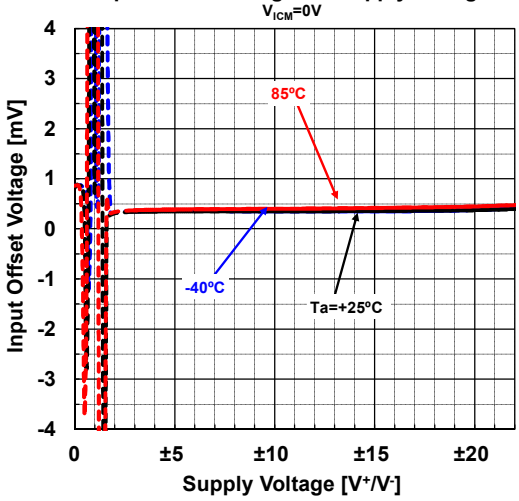
Supply Current vs. Supply Voltage
G_V=0dB



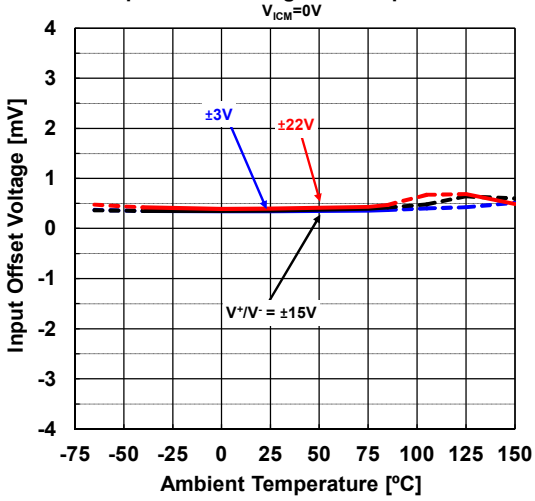
Supply Current vs. Temperature
G_V=0dB



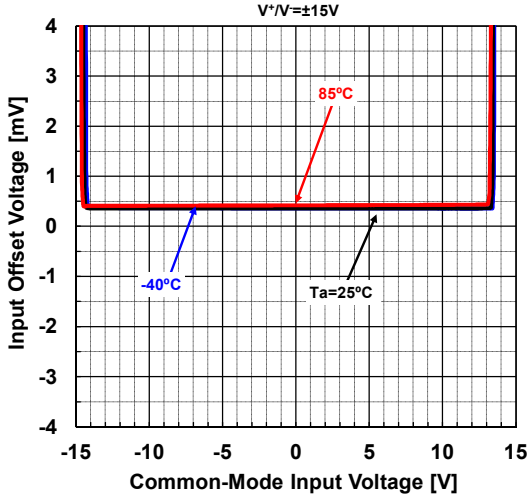
Input Offset Voltage vs. Supply Voltage
V_{ICM}=0V



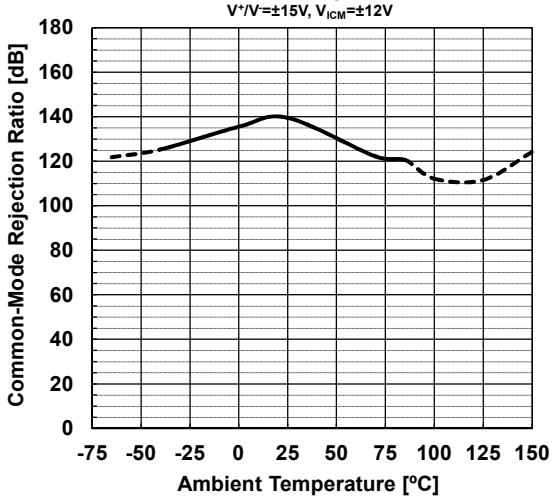
Input Offset Voltage vs. Temperature
V_{ICM}=0V



Input Offset Voltage vs.
Common-Mode Input Voltage
V+/V-=±15V

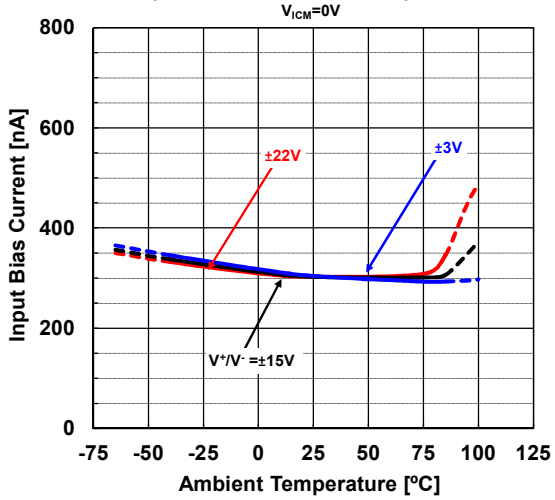


CMR vs. Temperature
V+/V-=±15V, V_{ICM}=±12V

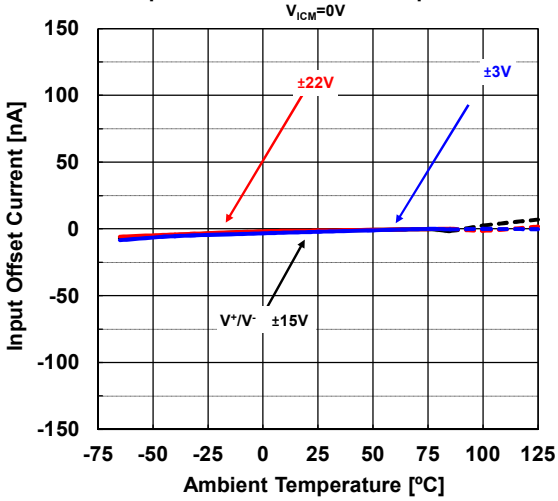


■ TYPICAL CHARACTERISTICS

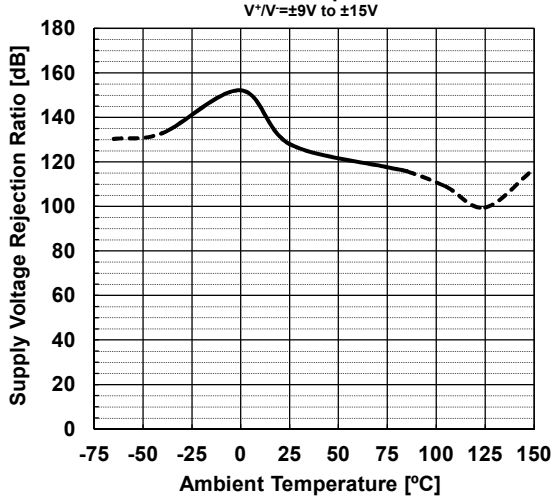
Input Bias Current vs. Temperature
V_{ICM}=0V



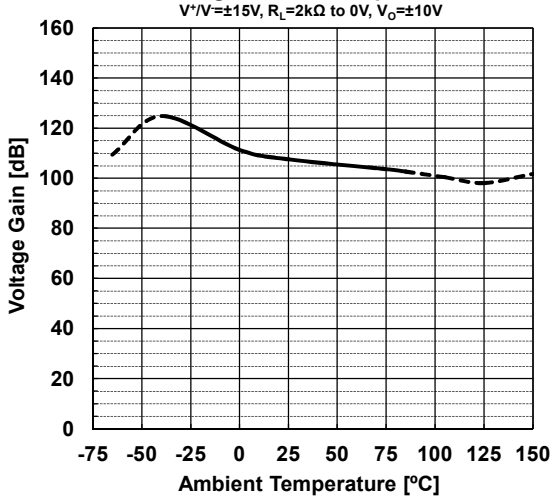
Input Offset Current vs. Temperature
V_{ICM}=0V



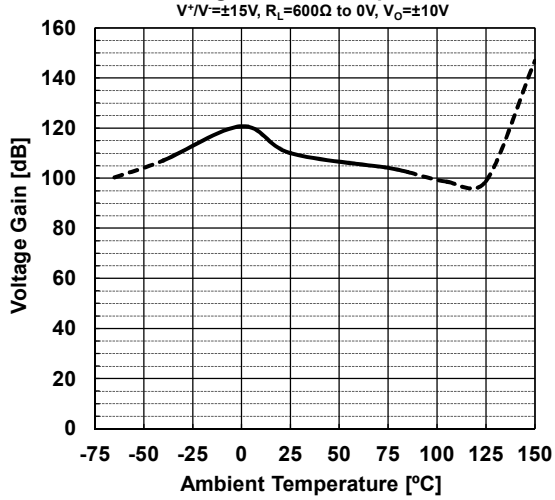
SVR vs. Temperature
V^+/V^-=±9V to ±15V



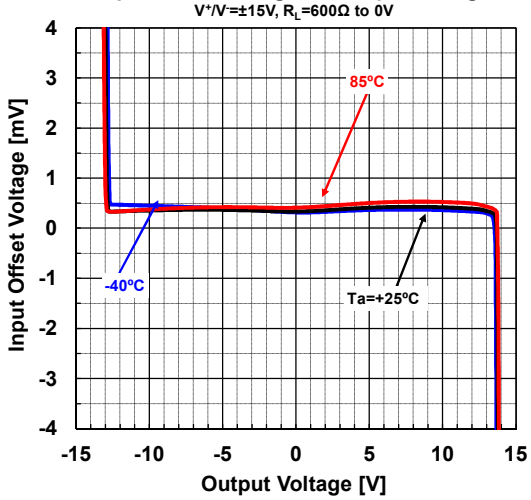
Voltage Gain vs. Temperature
V^+/V^-=±15V, R_L=2kΩ to 0V, V_O=±10V



Voltage Gain vs. Temperature
V^+/V^-=±15V, R_L=600Ω to 0V, V_O=±10V

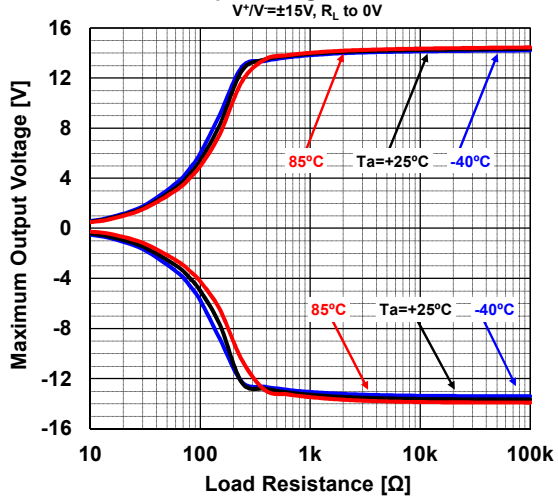


Input Offset Voltage vs. Output Voltage
V^+/V^-=±15V, R_L=600Ω to 0V

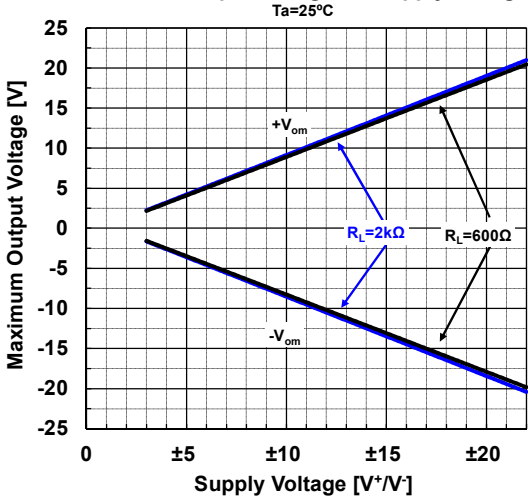


■ TYPICAL CHARACTERISTICS

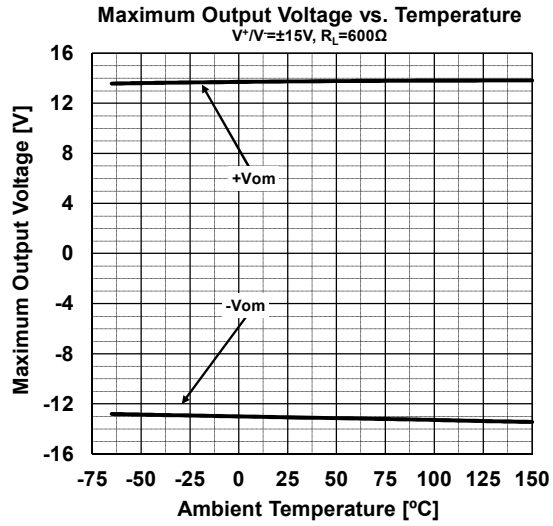
Maximum Output Voltage vs. Load Resistance



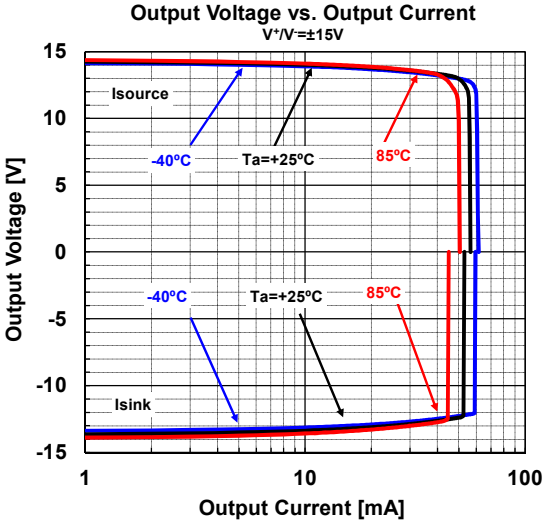
Maximum Output Voltage vs. Supply Voltage



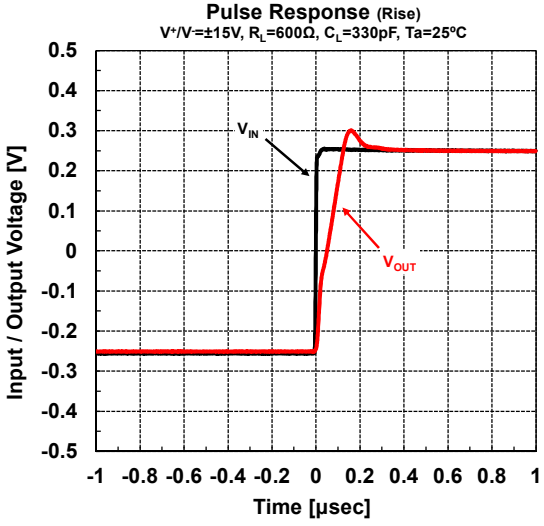
Maximum Output Voltage vs. Temperature



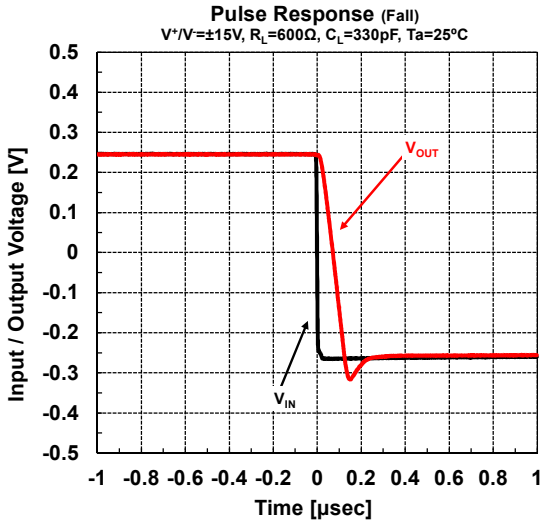
Output Voltage vs. Output Current



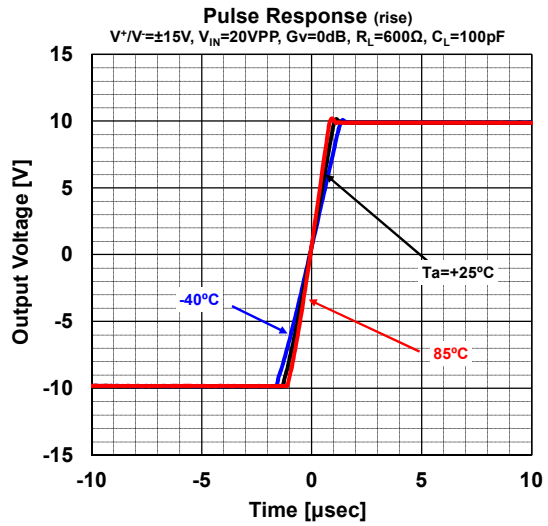
Pulse Response (Rise)

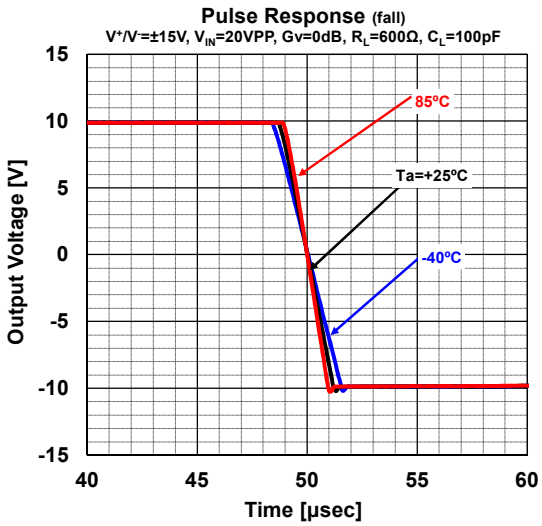


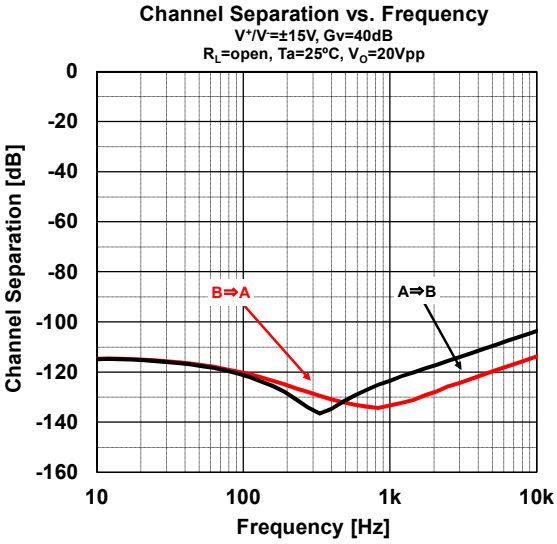
Pulse Response (Fall)



■ TYPICAL CHARACTERISTICS

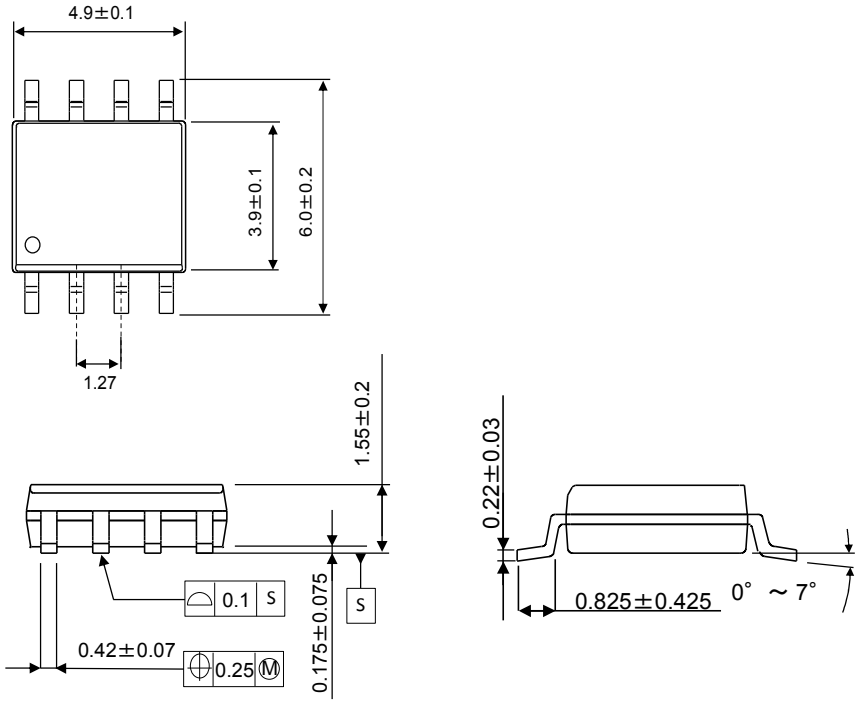






■PACKAGE OUTLINE UNIT : mm

SOP8



[CAUTION]
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