NJM5532C
LOW-NOISE DUAL OPERATIONAL AMPLIFIER

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.

APPLICATIONS

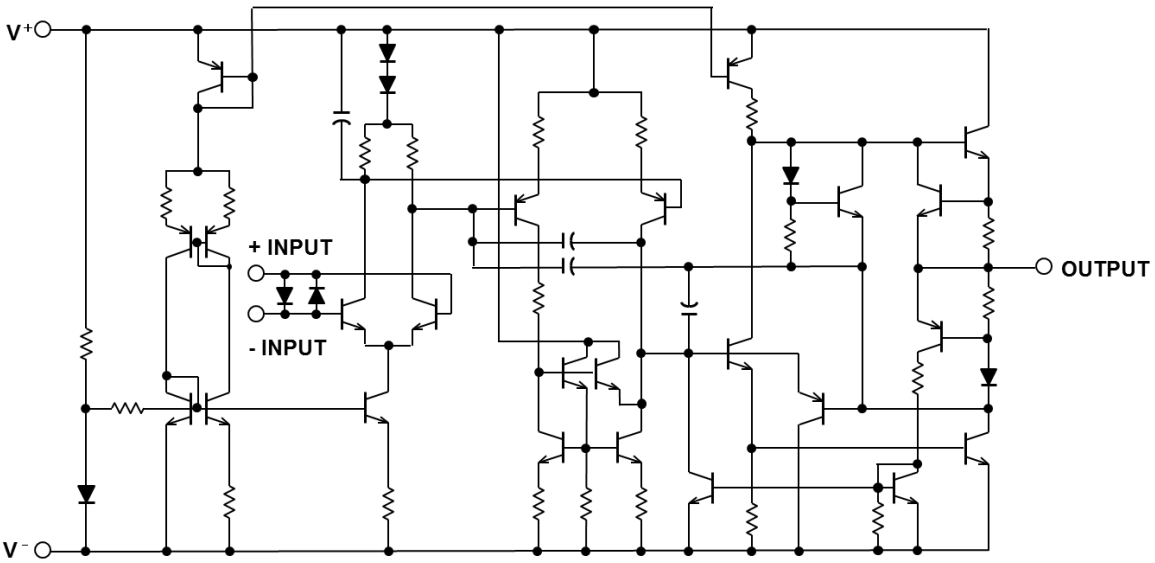
- Audio Pre-Amplifier
- Microphon Amplifier
- Line Amplifier
- Industrial

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.

EQUIVALENT CIRCUIT (Each Amplifier)



■ PRODUCT NAME INFORMATION

NJM5532C G (TE2)

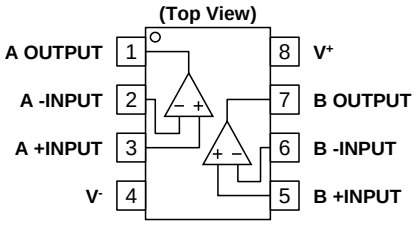
Description of configuration

Suffix	Parameter	Description
G	Package code	Indicates the package. Refer to the order information.
TE2	Packing	Refer to the packing specifications.

■ ORDER INFORMATION

Product Name	Package	RoHS	Halogen-Free	Terminal Finish	Marking	Weight (mg)	MOQ (pcs)
NJM5532CG (TE2)	SOP8	Yes	Yes	Pure Sn	5532C	88	2500

■ PIN DESCRIPTIONS



Pin No. SOP8	SYMBOL	I/O	DESCRIPTION
1	A OUTPUT	O	Output channel A
2	A -NPUT	I	Inverting input channel A
3	A +NPUT	I	Non-inverting input channel A
7	BOUTPUT	O	Output channel B
6	B -INPUT	I	Inverting input channel B
5	B +INPUT	I	Non-inverting input channel B
8	V+	-	Positive supply
4	V-	-	Negative supply or Ground (single supply)

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	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
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

ABSOLUTE MAXIMUM RATINGS
Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage and may degrade the lifetime and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

■ THERMAL CHARACTERISTICS

Package	Measurement Result		Unit
	Thermal Resistance (Θja)	Thermal Characterization Parameter (ψjt)	
SOP8	181 *1 / 125 *2	49 *1 / 43 *2	°C/W

qja:Junction-to-Ambient Thermal Resistance
ψjt:Junction-to-Top Thermal Characterization Parameter

*1 EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 2layers, FR-4) mounting

*2 EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 4layers, FR-4) mounting

■ ELECTROSTATIC DISCHARGE (ESD) PROTECTION VOLTAGE

Parameter	Conditions	Protection Voltage
HBM	C = 100 pF, R = 1.5 kΩ	±2000 V
CDM	Direct CDM	±1000 V

ELECTROSTATIC DISCHARGE RATINGS
The electrostatic discharge test is done based on JEITA ED-4701. In the HBM method, ESD is applied using the power supply pin and GND pin as reference pins.

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage	V^+ / V^-		±3 to ±22	V
Operating Temperature	T_a		−40 to 85	°C

RECOMMENDED OPERATING CONDITIONS
All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

■ ELECTRICAL CHARACTERISTICS

V^+ / V^- = ±15V, T_a = 25°C, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Offset Voltage *1	V_{IO}	R_S = 50Ω				
		T_a = 25°C	-	0.5	4	mV
		0°C<T_a< 70°C *2	-	-	5	mV
Input Offset Current *1	I_{IO}	T_a = 25°C	-	10	150	nA
		0°C<T_a< 70°C *2	-	-	200	nA
Input Bias Current *1	I_B	T_a = 25°C	-	200	800	nA
		0°C<T_a< 70°C *2	-	-	1000	nA
Open-Loop Voltage Gain1	A_{V1}	R_L ≥ 600Ω, V_O = ±10V				
		T_a = 25°C	83.5	94	-	dB
		0°C<T_a< 70°C *2	80	-	-	dB
Open-Loop Voltage Gain2	A_{V2}	R_L ≥ 2kΩ, V_O = ±10V				
		T_a = 25°C	88	100	-	dB
		0°C<T_a< 70°C *2	83.5	-	-	dB
Supply Voltage Rejection Ratio	SVR	R_S ≤ 10kΩ, V^+ / V^- = ±9V to ±15V	80	100	-	dB
Supply Current (All Amplifiers)	I_{SUPPLY}	No Signal	-	8	16	mA
Common-Mode Input Voltage Range	V_{ICM}		±12	±13	-	V
Common-Mode Rejection Ratio	CMR	R_S ≤ 10kΩ	70	100	-	dB
Output Short-Circuit Current*3	I_{SC}		20	50	75	mA
Maximum Output Voltage	V_{OM}	R_L ≥ 600Ω	±12	±13	-	V
		R_L ≥ 600Ω, V^+ / V^- = ±18V	±15	±16	-	V
Input Resistance	R_{IN}		30	150	-	kΩ
Output Resistance	R_O		-	0.3	-	Ω
Small-signal Voltage Gain	A_V	f = 10kHz	-	67	-	dB
Gain Bandwidth Product	GBW	R_L = 600Ω, C_L = 100pF	-	10	-	MHz
Powerband Width	WPG	R_L = 600Ω, V_O = ±10V	-	140	-	kHz
		R_L = 600Ω, V_O = ±14V, V^+ / V^- = ±18V	-	100	-	kHz
Equivalent Input Noise Voltage1	e_n	f = 30Hz	-	8	-	nV/√Hz
		f = 1kHz	-	5	-	nV/√Hz
Equivalent Input Noise Current	In	f = 30Hz	-	2.7	-	pA√Hz
		f = 1kHz	-	0.7	-	pA√Hz
Equivalent Input Noise Voltage2	V_{NI}	f = 20Hz to 20kHz	-	0.6	0.8	μVrms
Slew Rate	SR		-	9	-	V/us
Overshoot	K_{OV}	G_V = 1, V_{IN} = 100mV_{PP}, C_L = 100pF, R_L = 600Ω	-	10	-	%
Channel Separation	CS	f = 1kHz	-	110	-	dB

*1 Absolute values.

*2 These parameters are not 100% test.

*3 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.

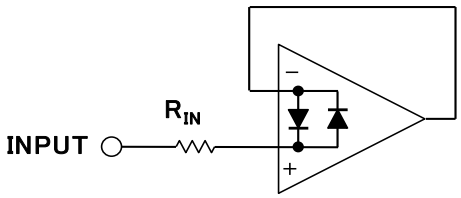
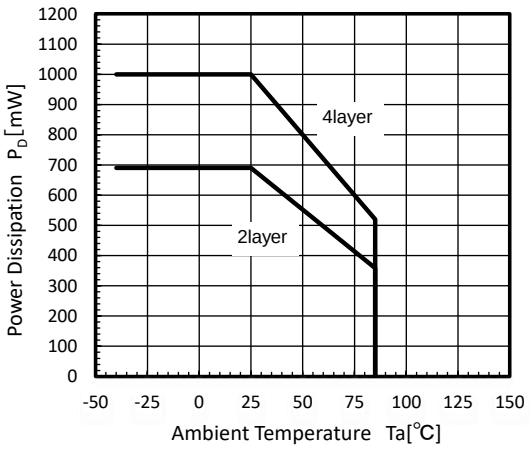


Fig. 1

• Caution to Thermal Design

If the NJM5532C junction temperature (Tj) exceeds 150°C 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, T_a = 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)

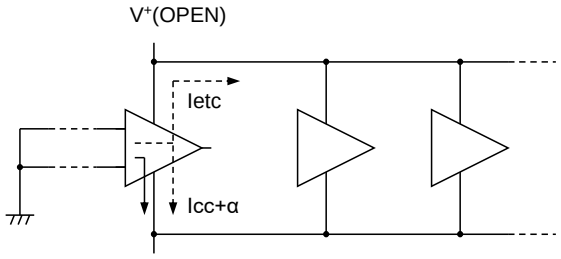


Fig. 2

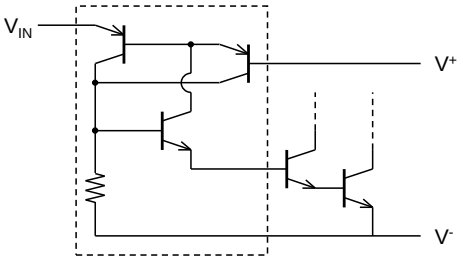


Fig. 3

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 (1kΩ or more) (Fig.5).

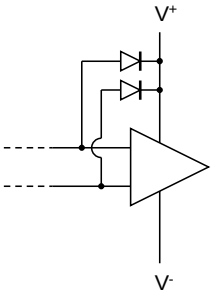


Fig. 4-1

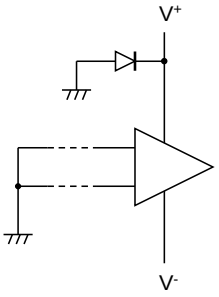


Fig. 4-1

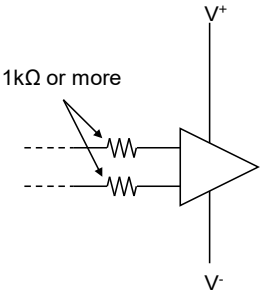
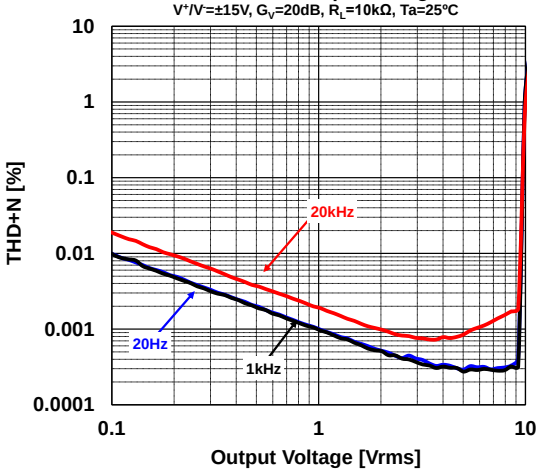


Fig. 5

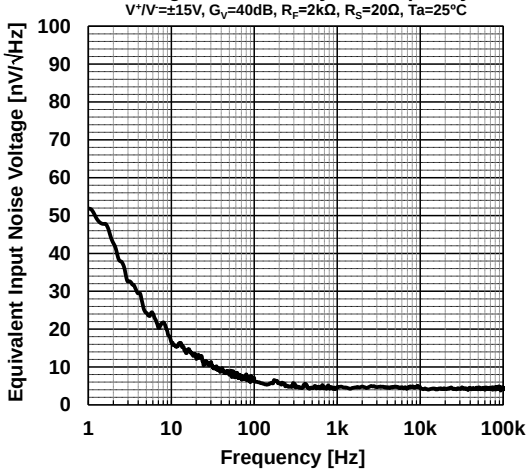
■ TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

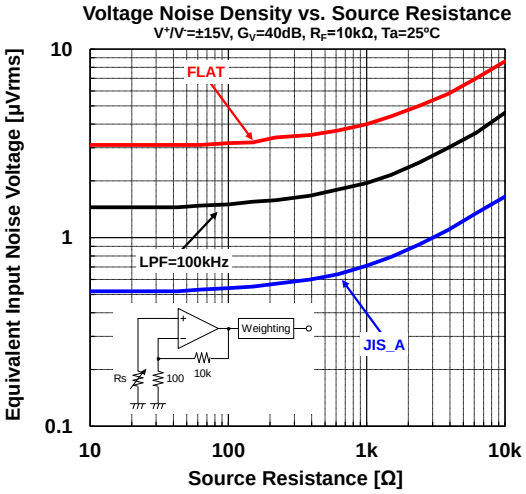
THD+N vs. Output Voltage



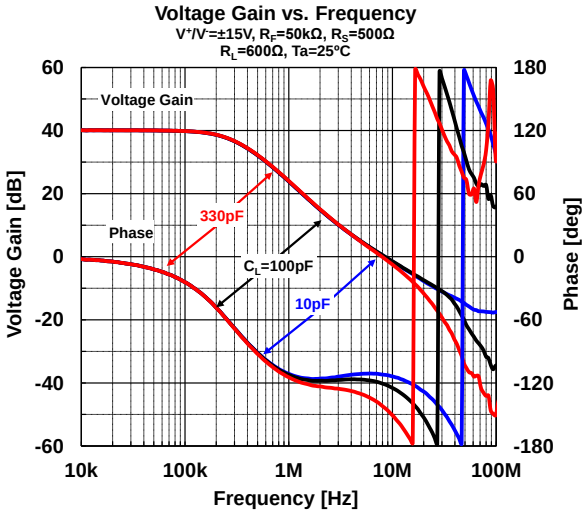
Voltage Noise Density vs. Frequency



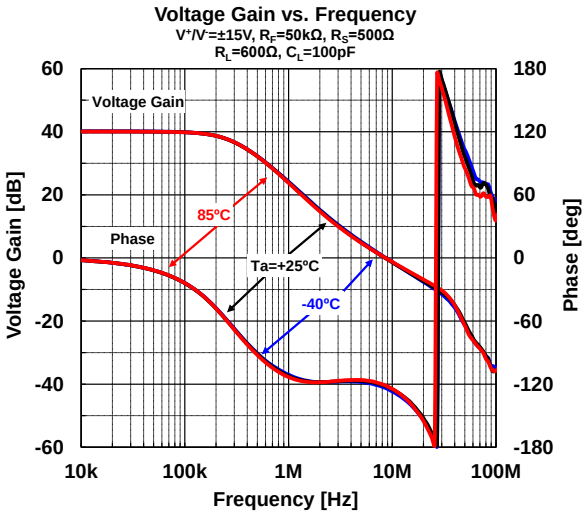
Voltage Noise Density vs. Source Resistance



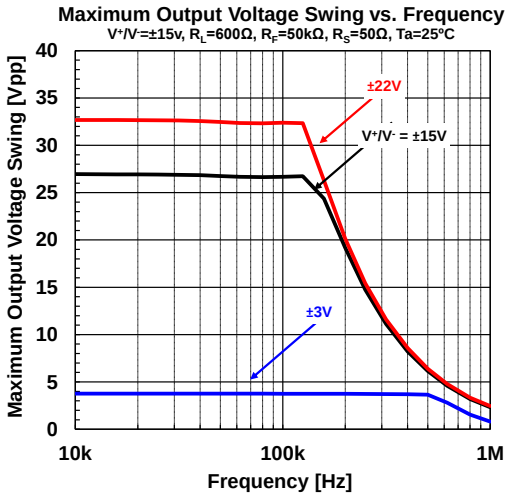
Voltage Gain vs. Frequency



Voltage Gain vs. Frequency



Maximum Output Voltage Swing vs. Frequency



■ TYPICAL CHARACTERISTICS

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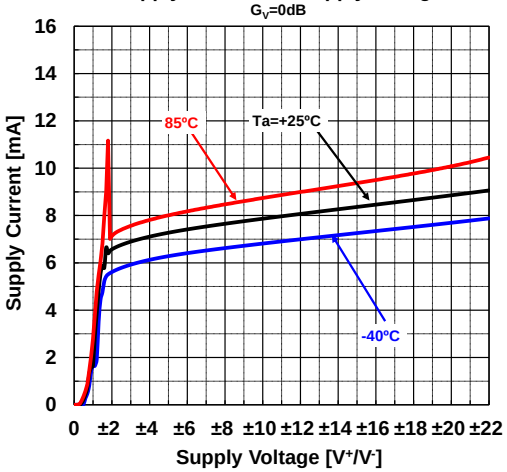
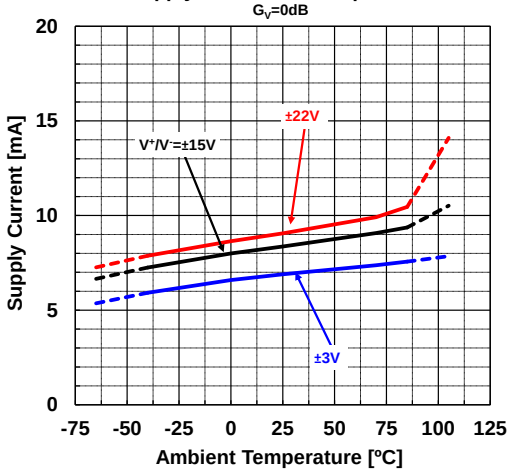
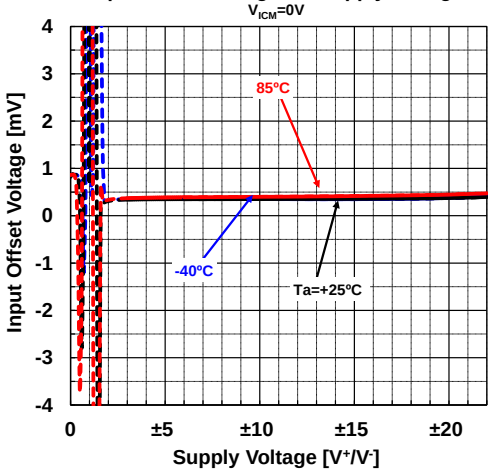
Supply Current vs. Supply Voltage
G_V=0dB



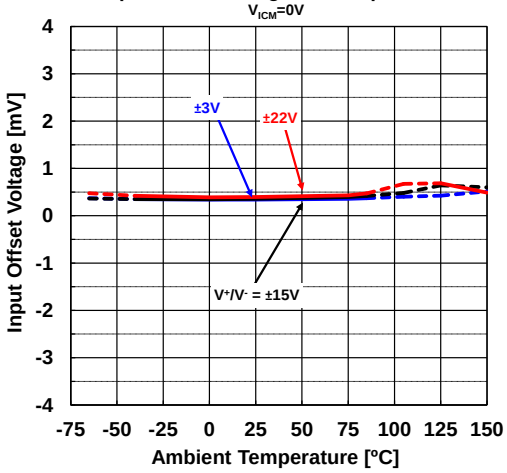
Supply Current vs. Temperature
G_V=0dB



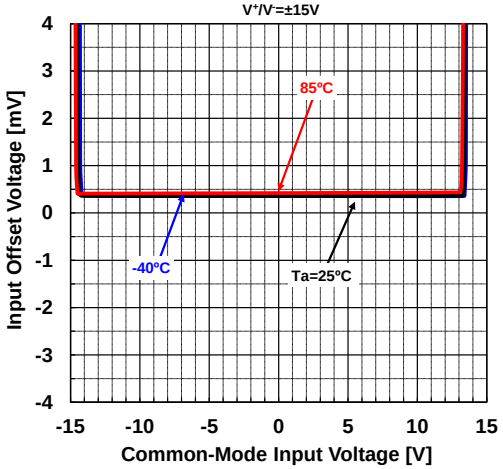
Input Offset Voltage vs. Supply Voltage
V_{ICM}=0V



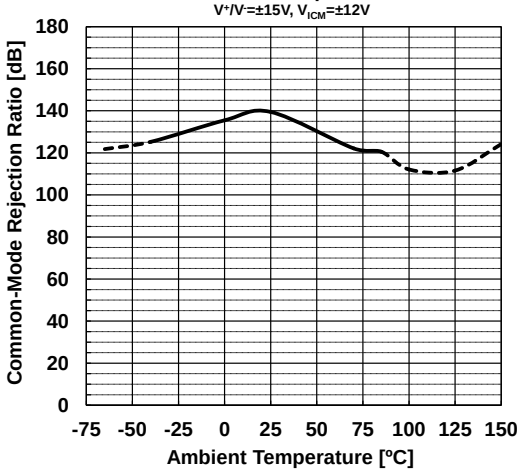
Input Offset Voltage vs. Temperature
V_{ICM}=0V



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



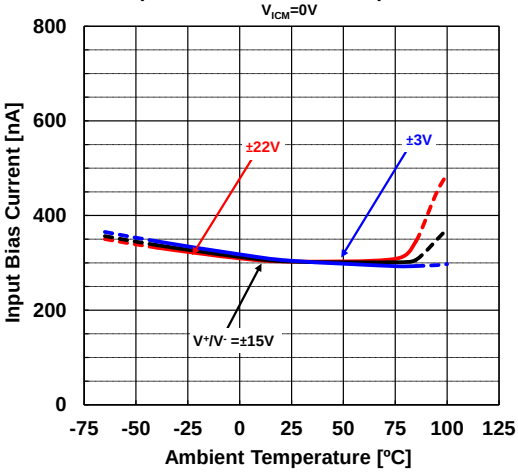
CMR vs. Temperature
V+/V-=±15V, V_{ICM}=±12V



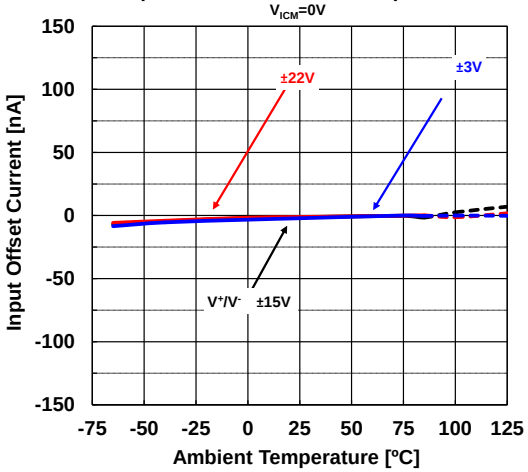
■ TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

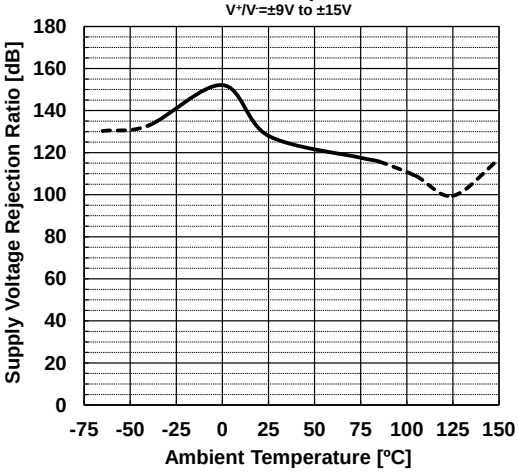
Input Bias Current vs. Temperature



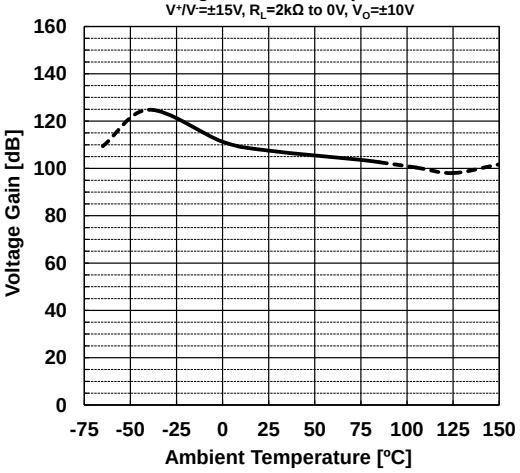
Input Offset Current vs. Temperature



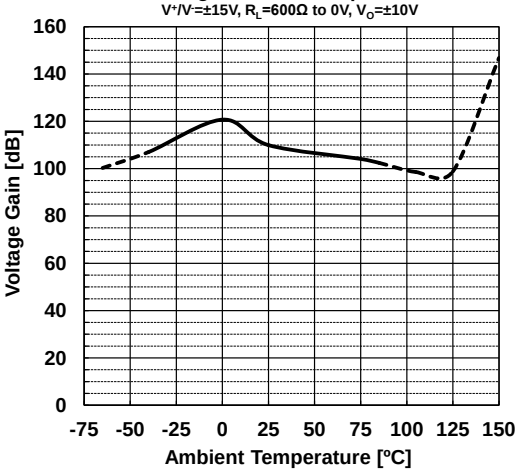
SVR vs. Temperature



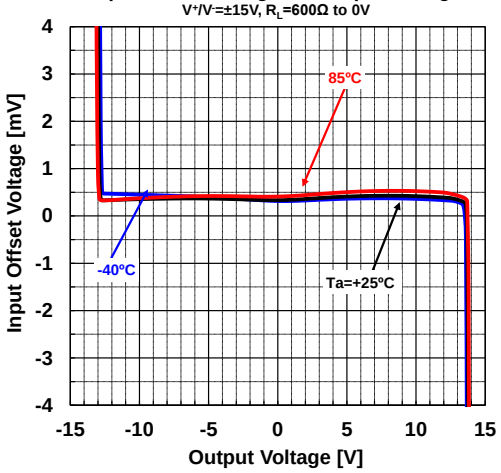
Voltage Gain vs. Temperature



Voltage Gain vs. Temperature



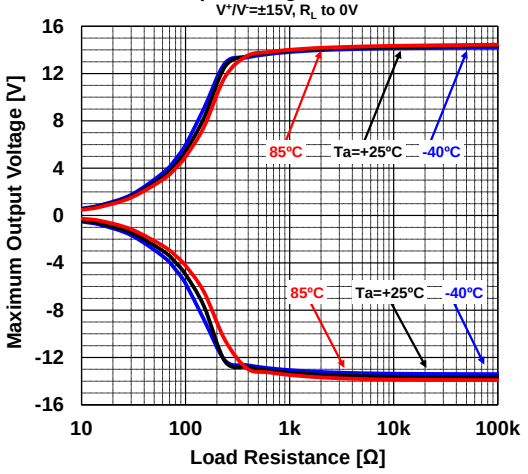
Input Offset Voltage vs. Output Voltage



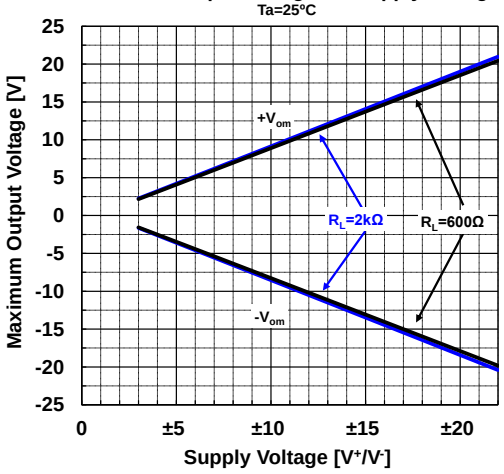
■ TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

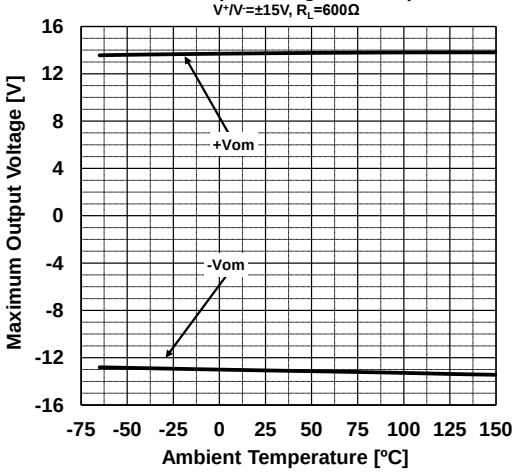
Maximum Output Voltage vs. Load Resistance
V⁺/V⁻=±15V, R_L to 0V



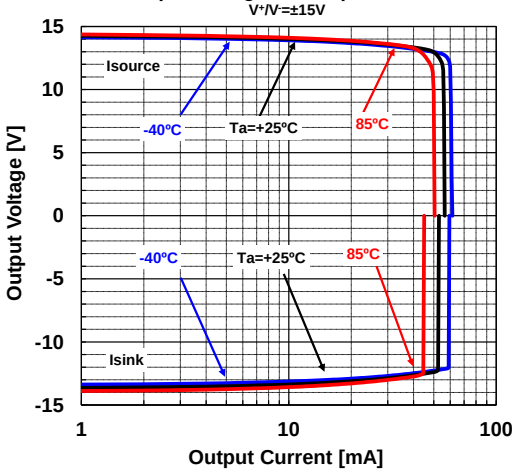
Maximum Output Voltage vs. Supply Voltage
Ta=25°C



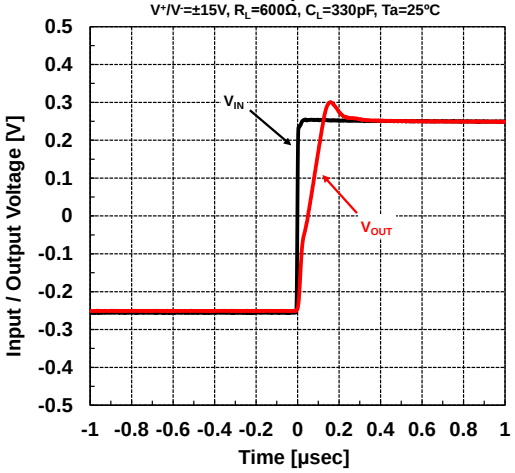
Maximum Output Voltage vs. Temperature
V⁺/V⁻=±15V, R_L=600Ω



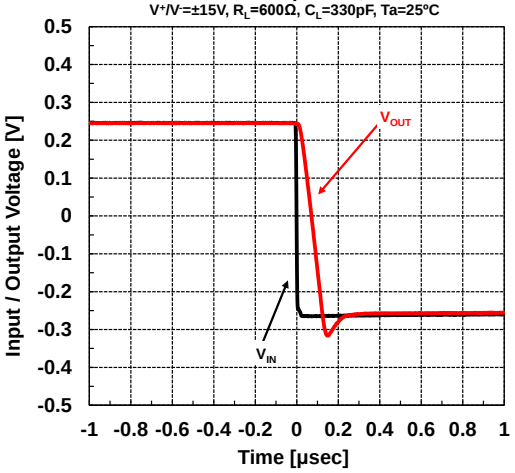
Output Voltage vs. Output Current
V⁺/V⁻=±15V



Pulse Response (Rise)
V⁺/V⁻=±15V, R_L=600Ω, C_L=330pF, Ta=25°C

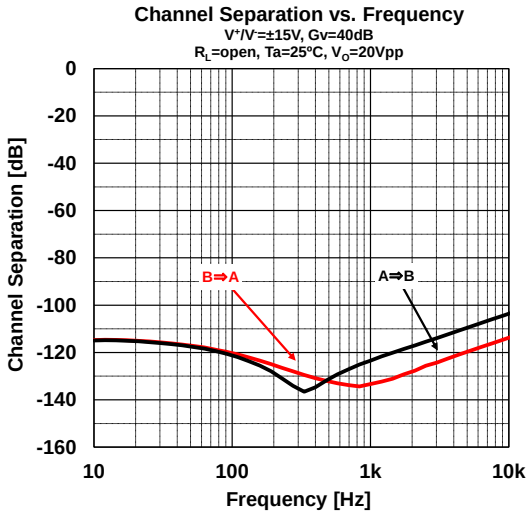


Pulse Response (Fall)
V⁺/V⁻=±15V, R_L=600Ω, C_L=330pF, Ta=25°C



■ TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.



■ REVISION HISTORY

Date	Revision	Changes
September 5, 2022	Ver.1.0	Changed data sheet format.

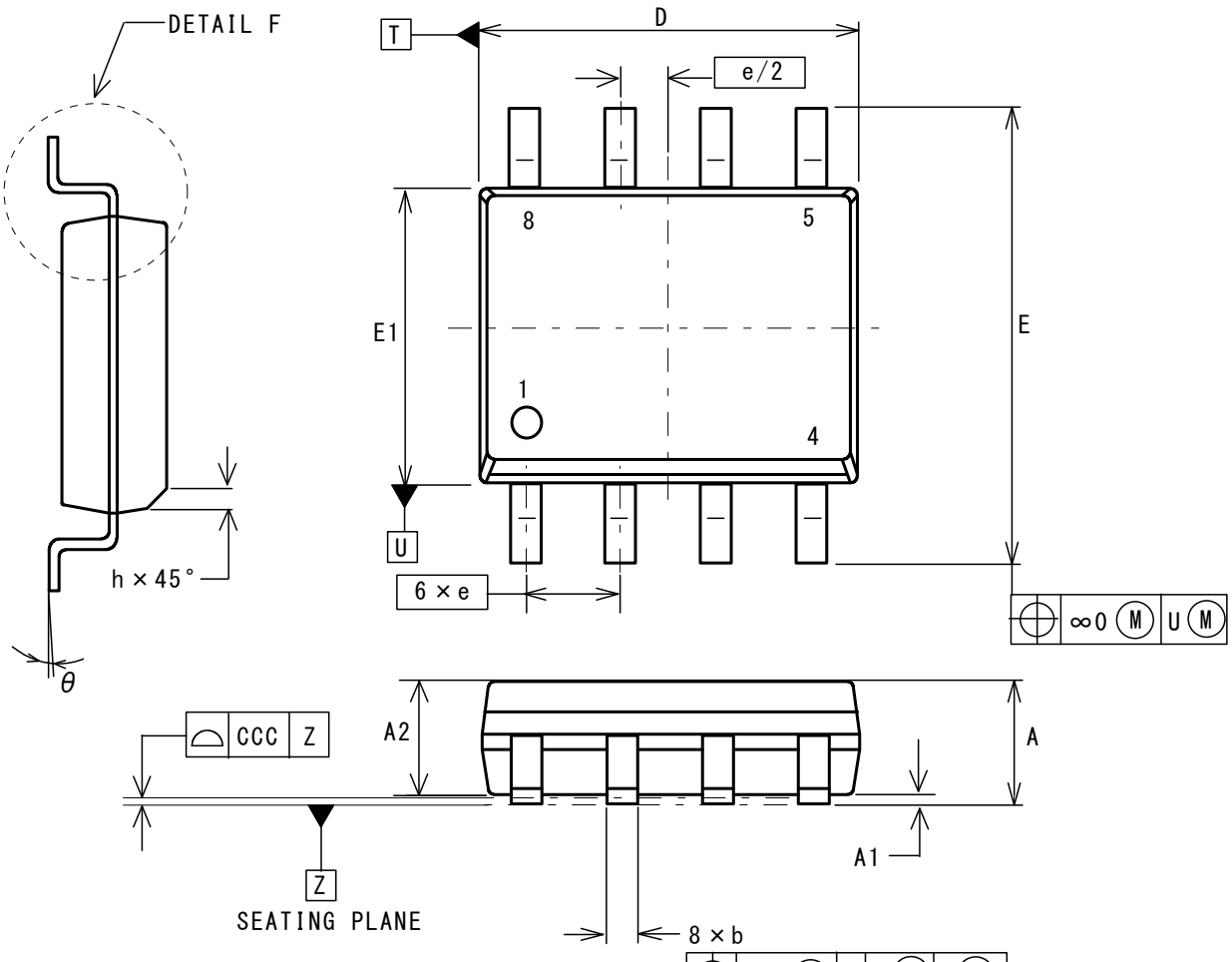
Nisshinbo Micro Devices Inc.

SOP8

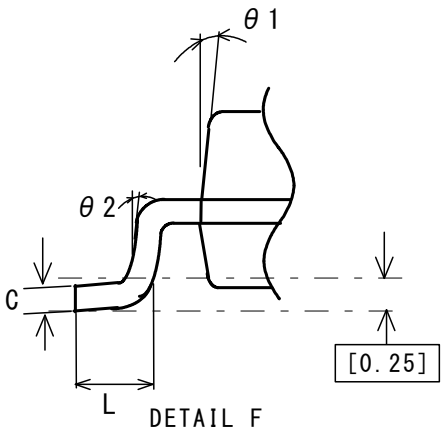
PI-SOP8-E-A

■ PACKAGE DIMENSIONS

UNIT: mm



DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NOM	MAX	MIN	NOM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A_1	.004		.010	0.10		0.25
MOLD THICKNESS	A_2	.049		–	1.25		–
LEAD WIDTH	b	.014		.019	0.35		0.49
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.189		.197	4.80		5.00
	E_1	.150		.157	3.80		4.00
LEAD PITCH	E	.228		.244	5.80		6.20
	e	.050 BSC			1.27 BSC		
	L	.015		.049	0.40		1.25
	h	.010		.020	0.25		0.50
	θ	0°		8°	0°		7°
	θ_1	5°		15°	5°		15°
	θ_2	2°	7°	12°	2°	7°	12°
LEAD EDGE OFFSET	∞0	.010			0.25		
LEAD OFFSET	bbb	.010			0.25		
COPLANARITY	CCC	.004			0.10		



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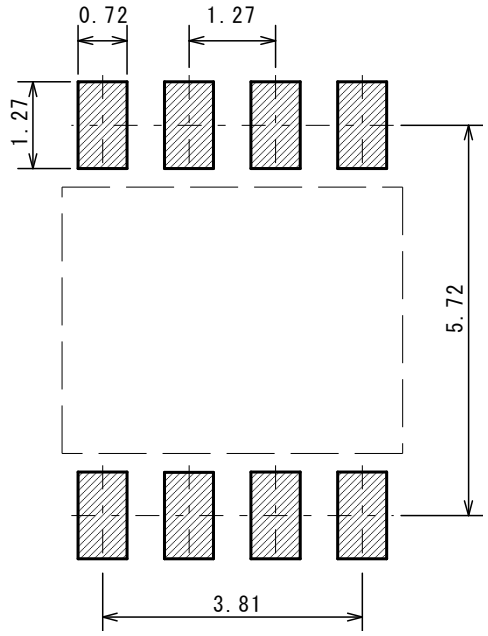
SOP8

PI-SOP8-E-A

■ EXAMPLE OF SOLDER PADS DIMENSIONS

UNIT: mm



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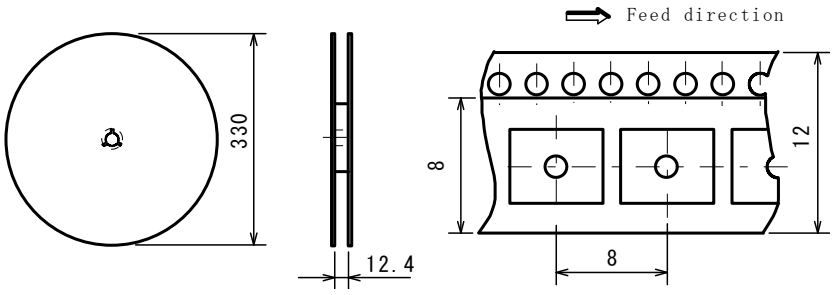
PI-SOP8-E-A

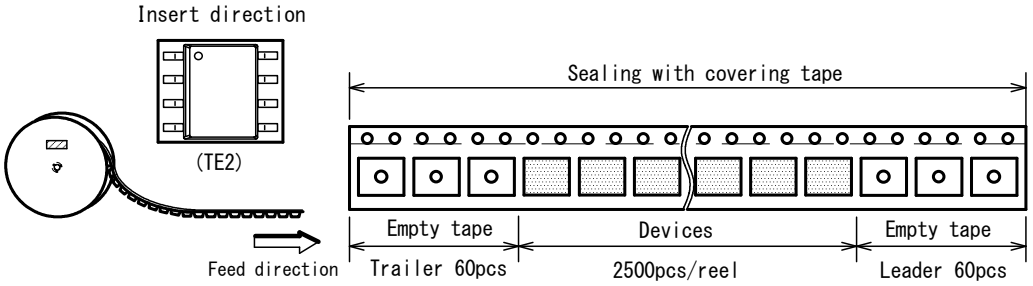
■ PACKING SPEC

UNIT: mm

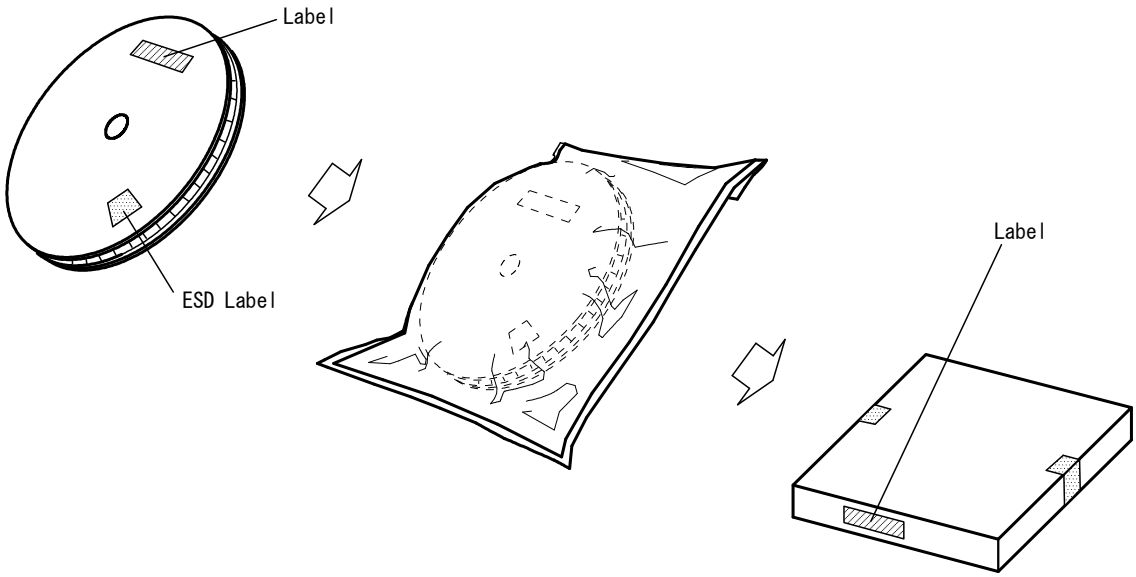
REEL DIMENSIONS / TAPING DIMENSIONS



TAPING STATE



PACKING STATE



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