Nisshinbo Micro Devices Inc.

NJM8532R-Z

Rail-to-Rail Input/Output Dual Operational Amplifier

FEATURES

- AEC-Q100 grade1
- Operating Temperature — Ta=-40°C to+125°C
- Operating Voltage — 1.8 to 14.0V
- Rail-to-Rail Input — V_{ICM}= 0 to 5.0V, at V^{+}=5V
- Rail-to-Rail Output — V_{OH}≥4.85V/ V_{OL}≤0.15V, at V^{+} = 5V, R_L = 20kΩ (Ta= -40°C to +125°C)
- Load Drivability — V_{OH}≥4.7V/ V_{OL}≤0.3V, at V^{+} = 5V, R_L = 2kΩ (Ta= -40°C to +125°C)
- Offset Voltage — 5mV max. (Ta=-40°C to +125°C)
- Slew Rate — 0.4V/µs typ.
- Low Input Voltage Noise — 10nV/√Hz typ. at f=1kHz
- Adequate phase margin — Φ_M=75deg. typ., at R_L=2kΩ
- Bipolar Technology
- Package Outline — MSOP8 (VSP8)

GENERAL DESCRIPTION

The NJM8532 is dual rail to rail input and output single supply operational amplifier featuring 14V supply voltage, low noise and low power.

A wide supply voltage range from 1.8V to 14V with a rail to rail input and output allows the device to be used in wide variety of applications, such as audio amplifier, hi-side current sensing, buffering and others. Furthermore, low supply current of 580µA typical at NJM8532 combined with a wide bandwidth of 1MHz and low very low noise of 10nV/√Hz at 1kHz make NJM8532 very suitable for a variety of battery-powered applications that require a good balance between low power, low noise and wide bandwidth.

■ PRODUCT NAME INFORMATION

NJM8532 R - Z (TE2)

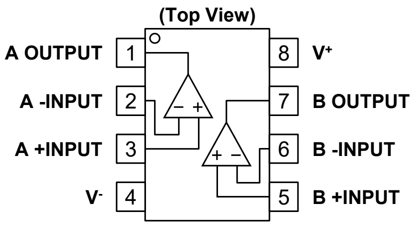
Description of configuration

Suffix	Parameter	Description
R	Package code	Indicates the package. R : MSOP8 (VSP8)
Z	Quality grade	Automotive.
TE2	Packing	Refer to the packing specifications.

■ ORDER INFORMATION

Product Name	Package	RoHS	Halogen-Free	Terminal Finish	Marking	Weight (mg)	MOQ (pcs)
NJM8532R-Z (TE2)	MSOP8 (VSP8)	✓	✓	Sn2Bi	8532Z	21	2000

■ PIN DESCRIPTIONS



Pin No. MSOP8 (VSP8)	Symbol	I/O	Description
1	A OUTPUT	O	Output channel A
2	A −INPUT	I	Inverting input channel A
3	A +INPUT	I	Non-inverting input channel A
7	B OUTPUT	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 GND (single supply)

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit
Supply Voltage	V^+	15.0	V
Differential Input Voltage Range	V_{ID}	±1.0	V
Common Mode Input Voltage Range	V_{ICM}	-0.3 to V⁺ + 0.3 *1	V
Input Current	I_{IN}	2 *2	mA
Power Dissipation *3	P_D	500 *3	mW
Storage Temperature Range	T_{stg}	-40 to +150	˚C

*1 For supply voltage less than 15V, the absolute maximum input voltage is equal to the supply voltage.

*2 The inputs are protected by diodes. If the differential input voltage exceeds 1.0V, the input current must be limited 2 mA or less by using a restriction resistance. Input voltages outside the supply voltage will be clamped by ESD protection diodes. If the input voltage exceeds the supply voltage, the input current must be limited 2 mA or less by using a restriction resistance.

*3 On the PCB "EIA/JEDEC (76.2 × 114.3 × 1.6 mm, 2 layers, FR-4)"

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)	
MSOP8 (VSP8)	250	62	°C/W

θja:Junction-to-Ambient Thermal Resistance
ψjt:Junction-to-Top Thermal Characterization Parameter
On the PCB "EIA/JEDEC (76.2 × 114.3 × 1.6 mm, 2 layers, FR-4)"

■ 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^{+}		1.8 to 14	V
Operating Temperature	Ta		-40 to 125	°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 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 1

$V^+ = 5V$, Ta = 25°C, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DC CHARACTERISTICS						
Operating Current	I_{CC}	No signal applied	-	580	900	µA
		No signal applied,Ta=-40 °C to +125 °C	-	-	900	
Input Offset Voltage	V_{IO}		-	1	4	mV
		Ta=-40 °C to +125 °C	-	-	5	
Input Bias Current	I_B		-	50	250	nA
		Ta=-40 °C to +125 °C	-	-	275	
Input Offset Current	I_{IO}		-	5	100	nA
		Ta=-40 °C to +125 °C	-	-	100	
Large Signal Voltage Gain	A_V	V_{OUT}=1.5V to 3.5V,R_L=2kΩ to 2.5V	60	85	-	dB
		V_{OUT}=1.5V to 3.5V,R_L=2kΩ to 2.5V, Ta=-40 °C to +125 °C	60	-	-	
Common Mode Rejection Ratio	CMR	CMR+: 2.5V≤V_{CM}≤5V, CMR-: 0V≤V_{CM}≤2.5V *4	55	70	-	dB
		CMR+: 2.5V≤V_{CM}≤5V, CMR-: 0V≤V_{CM}≤2.5V *4 Ta=-40 °C to +125 °C	55	-	-	
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±2.0V to ±3.0V	70	85	-	dB
		V^+/V^-=±2.0V to ±3.0V, Ta=-40 °C to +125 °C	70	-	-	
Maximum Output Voltage 1	V_{OH1}	R_L=20kΩ to 2.5V	4.90	4.95	-	V
		R_L=20kΩ to 2.5V, Ta=-40 °C to +125 °C	4.85	-	-	
	V_{OL1}	R_L=20kΩ to 2.5V	-	0.05	0.10	V
		R_L=20kΩ to 2.5V, Ta=-40 °C to +125 °C	-	-	0.15	
Maximum Output Voltage 2	V_{OH2}	R_L=2kΩ to 2.5V	4.75	4.85	-	V
		R_L=2kΩ to 2.5V, Ta=-40 °C to +125 °C	4.70	-	-	
	V_{OL2}	R_L=2kΩ to 2.5V	-	0.15	0.25	V
		R_L=2kΩ to 2.5V, Ta=-40 °C to +125 °C	-	-	0.30	
Input Common Mode Voltage Range	V_{ICM}	CMR≥55dB	0	-	5	V
		CMR≥55dB, Ta=-40 °C to +125 °C	0	-	5	
AC CHARACTERISTICS						
Gain Bandwidth Product	GBW	R_L=2kΩ	-	1	-	MHz
Phase Margin	Φ_M	R_L=2kΩ	-	75	-	Deg
Equivalent Input Noise Voltage	e_n	f=1kHz	-	10	-	nV/√Hz
TRANSIENT CHARACTERISTICS						
Slew Rate	SR	R_L=2kΩ	-	0.4	-	V/µs

*4 CMR is represented by either CMR+ or CMR- has lower value.
CMR+ is measured with 2.5V≤V_{CM}≤5.0 and CMR- is measured with 0V≤V_{CM}≤2.5V.

■ ELECTRICAL CHARACTERISTICS 2

V^+ = 3V, Ta = 25°C, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DC CHARACTERISTICS						
Operating Current	I_{CC}	No signal applied	-	510	880	μA
		No signal applied,Ta=-40 ˚C to +125 ˚C	-	-	880	
Input Offset Voltage	V_{IO}		-	1	4	mV
		Ta=-40 ˚C to +125 ˚C	-	-	5	
Input Bias Current	I_B		-	50	250	nA
		Ta=-40 ˚C to +125 ˚C	-	-	275	
Input Offset Current	I_{IO}		-	5	100	nA
		Ta=-40 ˚C to +125 ˚C	-	-	100	
Large Signal Voltage Gain	A_V	V_{OUT}=0.5V to 2.5V,R_L=2kΩ to 1.5V	60	84	-	dB
		V_{OUT}=0.5V to 2.5V,R_L=2kΩ to 1.5V, Ta=-40 ˚C to +125 ˚C	60	-	-	
Common Mode Rejection Ratio	CMR	CMR+: 1.5V≤V_{CM}≤3V, CMR-: 0V≤VCM≤1.5V *5	48	63	-	dB
		CMR+: 1.5V≤VCM≤3V, CMR-: 0V≤VCM≤1.5V *5, Ta=-40 ˚C to +125 ˚C	48	-	-	
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±1.2V to ±2.0V	68	83	-	dB
		V^+/V^-=±1.2V to ±2.0V, Ta=-40 ˚C to +125 ˚C	65	-	-	
Maximum Output Voltage 1	V_{OH1}	R_L=20kΩ to 1.5V	2.90	2.95	-	V
		R_L=20kΩ to 1.5V, Ta=-40 ˚C to +125 ˚C	2.85	-	-	
	V_{OL1}	R_L=20kΩ to 1.5V	-	0.05	0.10	V
		R_L=20kΩ to 1.5V, Ta=-40 ˚C to +125 ˚C	-	-	0.15	
Maximum Output Voltage 2	V_{OH2}	R_L=2kΩ to 1.5V	2.75	2.85	-	V
		R_L=2kΩ to 1.5V, Ta=-40 ˚C to +125 ˚C	2.70	-	-	
	V_{OL2}	R_L=2kΩ to 1.5V	-	0.15	0.25	V
		R_L=2kΩ to 1.5V, Ta=-40 ˚C to +125 ˚C	-	-	0.30	
Input Common Mode Voltage Range	V_{ICM}	CMR≥48dB	0	-	3	V
		CMR≥48dB, Ta=-40 ˚C to +125 ˚C	0	-	3	
AC CHARACTERISTICS						
Gain Bandwidth Product	GBW	R_L=2kΩ	-	1	-	MHz
Phase Margin	Φ_M	R_L=2kΩ	-	75	-	Deg
Equivalent Input Noise Voltage	e_n	f=1kHz	-	10	-	nV/√Hz
TRANSIENT CHARACTERISTICS						
Slew Rate	SR	R_L=2kΩ	-	0.35	-	V/μs

*5 CMR is represented by either CMR+ or CMR-has lower value.
CMR+ is measured with 1.5V≤V_{CM}≤3.0 and CMR- is measured with 0V≤V_{CM}≤1.5V.

■ ELECTRICAL CHARACTERISTICS 3

V^+ = 1.8V, Ta = 25°C, unless otherwise specified.

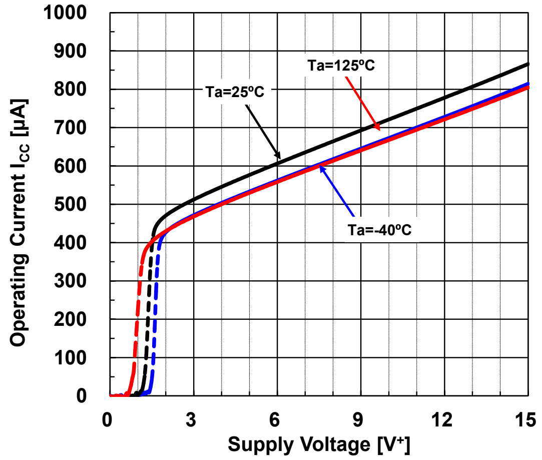
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DC CHARACTERISTICS						
Operating Current	I_{CC}	No signal applied	-	460	800	µA
		No signal applied, Ta=-40 ˚C to +125 ˚C	-	-	800	
Input Offset Voltage	V_{IO}		-	1	4	mV
		Ta=-40 ˚C to +125 ˚C	-	-	5	
Input Bias Current	I_B		-	50	250	nA
		Ta=-40 ˚C to +125 ˚C	-	-	275	
Input Offset Current	I_{IO}		-	5	100	nA
		Ta=-40 ˚C to +125 ˚C	-	-	100	
Large Signal Voltage Gain	A_V	V_{OUT}=0.4V to 1.4V, R_L=2kΩ to 0.9V	60	83	-	dB
		V_{OUT}=0.4V to 1.4V, R_L=2kΩ to 0.9V, Ta=-40 ˚C to +125 ˚C	60	-	-	
Common Mode Rejection Ratio	CMR	CMR+: 0. 9V≤V_{CM}≤1.8V, CMR-: 0V≤V_{CM}≤0.9V *6	40	55	-	dB
		CMR+: 0. 9V≤V_{CM}≤1.8V, CMR-: 0V≤V_{CM}≤0.9V *6, Ta=-40 ˚C to +125 ˚C	40	-	-	
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±0.9V to ±1.2V	65	80	-	dB
		V^+/V^-=±0.9V to ±1.2V, Ta=-40 ˚C to +125 ˚C	60	-	-	
Maximum Output Voltage 1	V_{OH1}	R_L=20kΩ to 0.9V	1.70	1.75	-	V
		R_L=20kΩ to 0.9V, Ta=-40 ˚C to +125 ˚C	1.65	-	-	
	V_{OL1}	R_L=20kΩ to 0.9V	-	0.05	0.10	V
		R_L=20kΩ to 0.9V, Ta=-40 ˚C to +125 ˚C	-	-	0.15	
Maximum Output Voltage 2	V_{OH2}	R_L=2kΩ to 0.9V	1.55	1.65	-	V
		R_L=2kΩ to 0.9V, Ta=-40 ˚C to +125 ˚C	1.50	-	-	
	V_{OL2}	R_L=2kΩ to 0.9V	-	0.15	0.25	V
		R_L=2kΩ to 0.9V, Ta=-40 ˚C to +125 ˚C	-	-	0.30	
Input Common Mode Voltage Range	V_{ICM}	CMR≥40dB	0	-	1.8	V
		CMR≥40dB, Ta=-40 ˚C to +125 ˚C	0	-	1.8	
AC CHARACTERISTICS						
Gain Bandwidth Product	GBW	R_L=2kΩ	-	1	-	MHz
Phase Margin	Φ_M	R_L=2kΩ	-	75	-	Deg
Equivalent Input Noise Voltage	e_n	f=1kHz	-	10	-	nV/√Hz
TRANSIENT CHARACTERISTICS						
Slew Rate	SR	R_L=2kΩ	-	0.3	-	V/µs

*6 CMR is represented by either CMR+ or CMR-has lower value.
CMR+ is measured with 0.9V≤V_{CM}≤1.8 and CMR- is measured with 0V≤V_{CM}≤0.9V.

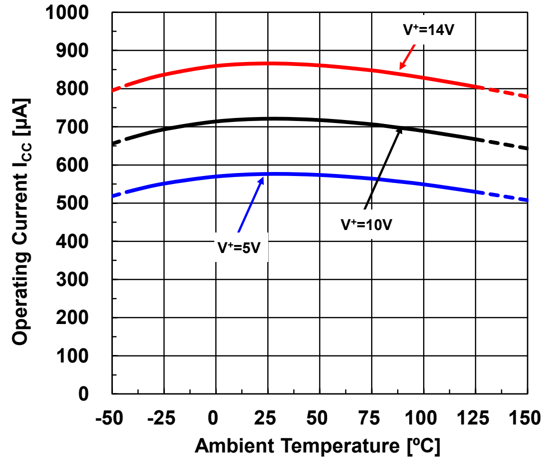
■ TYPICAL CHARACTERISTICS

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

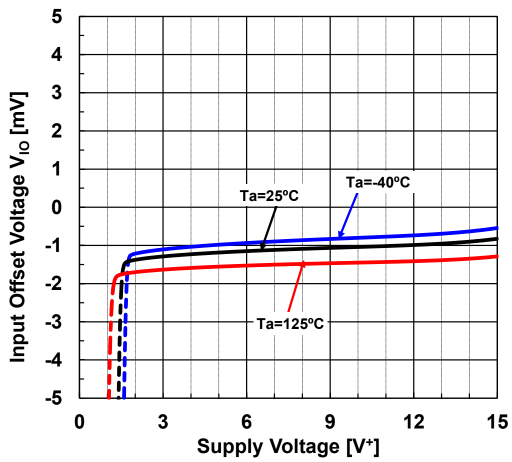
Supply Current vs. Supply Voltage
(correlation with Ta)
G_V=0dB



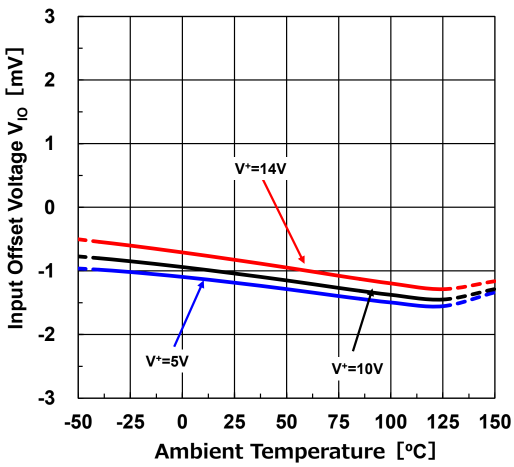
Supply Current vs. Ambient Temperature
G_V=0dB



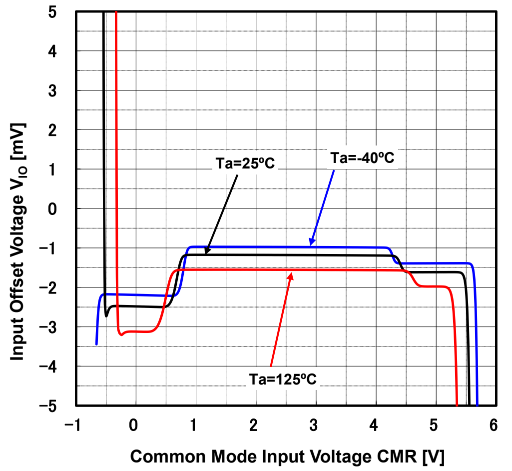
Input Offset Voltage vs. Supply Voltage
(correlation with Ta)
V_{ICM}=1/2V+



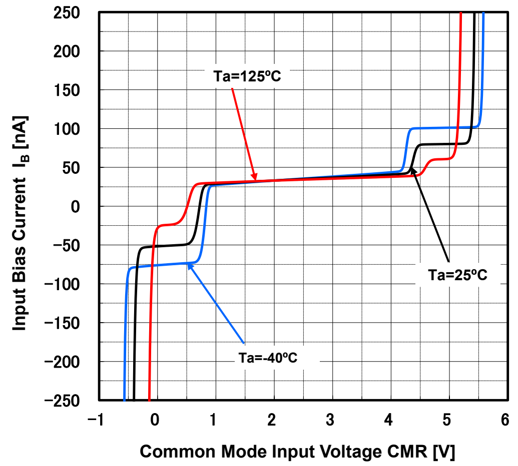
Input Offset Voltage vs. Ambient Temperature
V_{ICM}=1/2V+



Input Offset Voltage vs. Common Mode Input Voltage
(correlation with Ta)
V+=5V



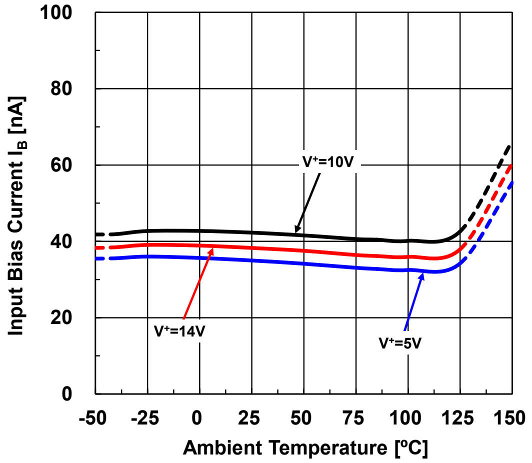
Input Bias Current vs. Common Mode Input Voltage
(correlation with Ta)
V+=5V



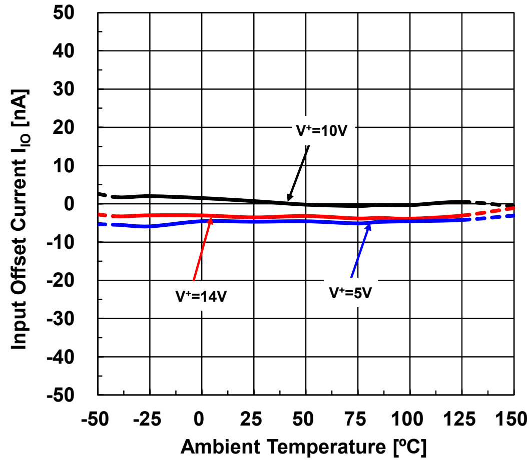
■ TYPICAL CHARACTERISTICS

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

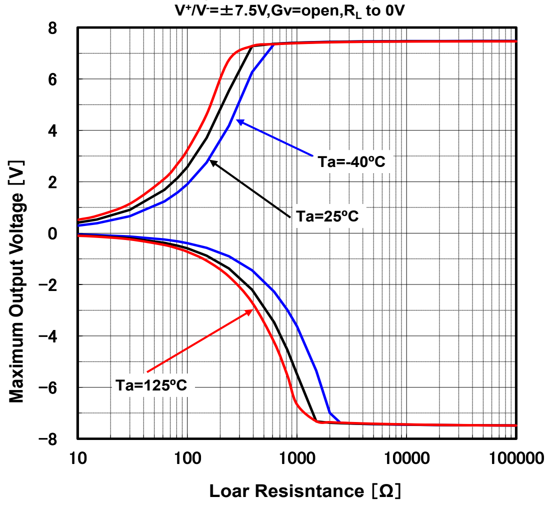
Input Bias Current vs. Ambient Temperature



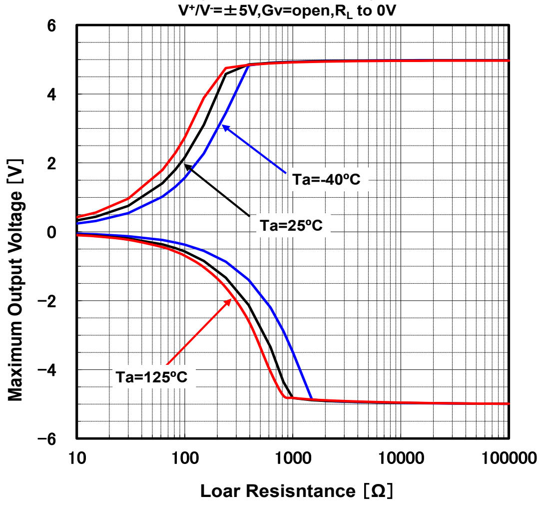
Input Offset Current vs. Ambient Temperature



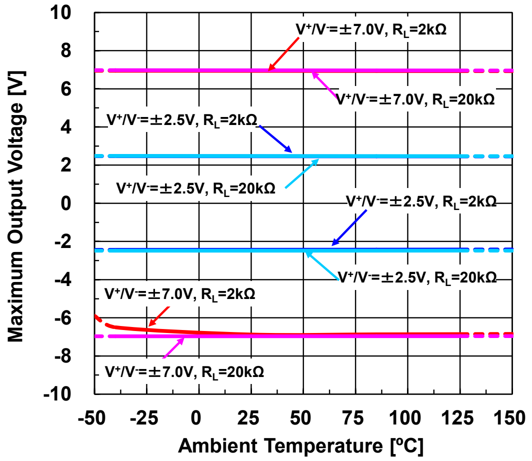
Maximum Outvs. Load Resistance
(correlation with Ta)
$V^+/V^-=\pm7.5V$,Gv=open,R_L to 0V



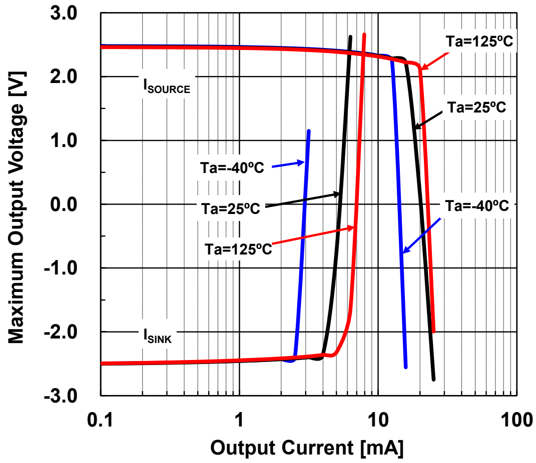
Maximum Outvs. Load Resistance
(correlation with Ta)
$V^+/V^-=\pm5V$,Gv=open,R_L to 0V



Maximum Output Voltage vs. Ambient Temperature
Gv=open, R_L to 0V



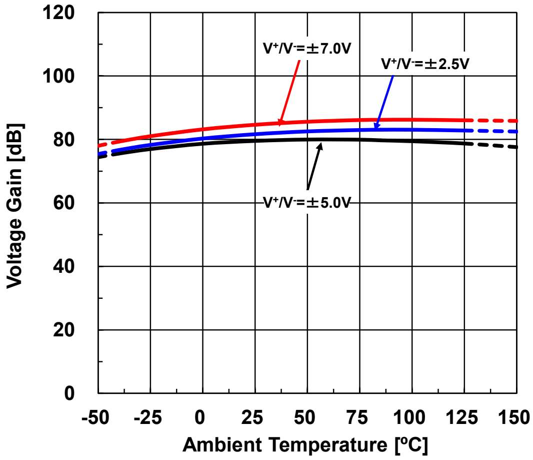
Maximum Output Voltage vs. Output Current
(correlation with Ta)
$V^+/V^-=\pm2.5V$, G_V=OPEN



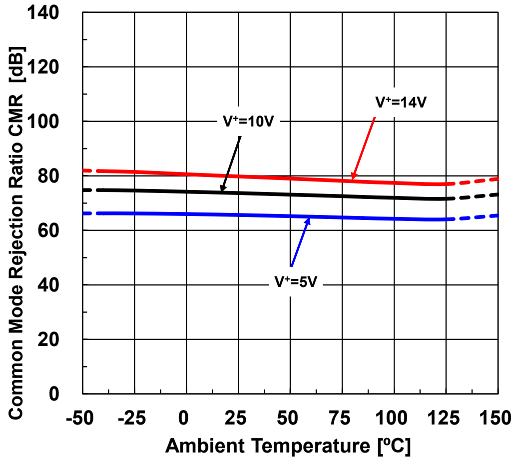
■ TYPICAL CHARACTERISTICS

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

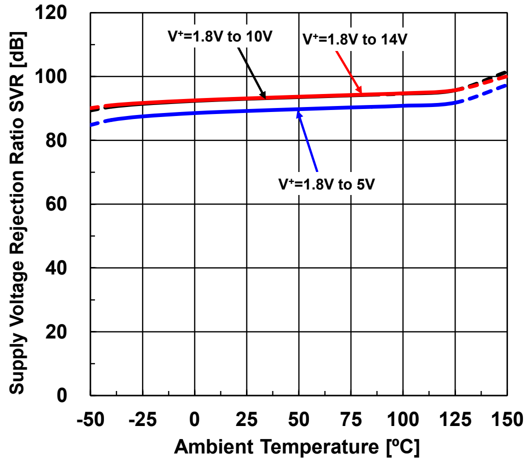
Voltage Gain vs. Ambient Temperature
R_L=2kΩ to 0V



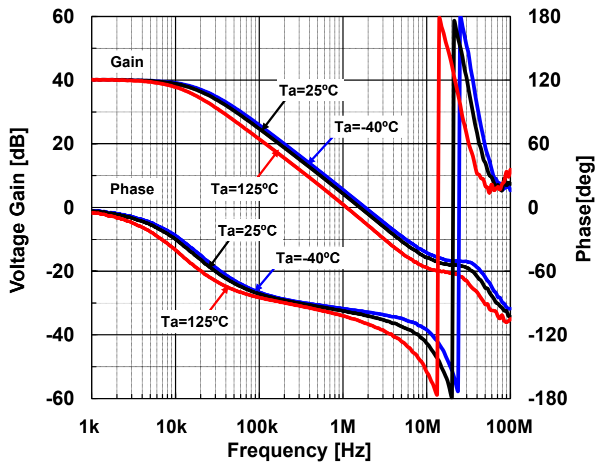
Common Mode Rejection Ratio vs. Ambient Temperature
V_{ICM}=0V to 1/2V+



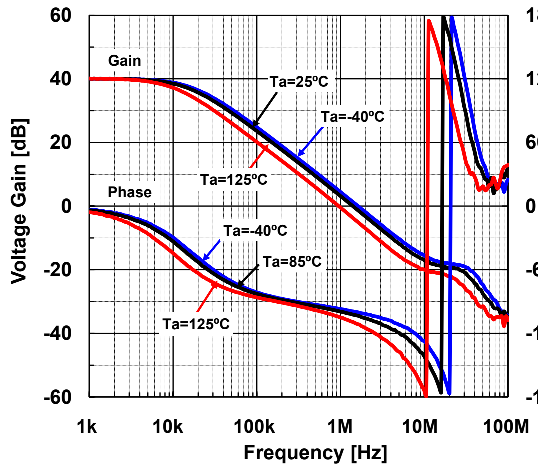
Supply Voltage Rejection Ratio vs. Ambient Temperature
V_{ICM}=1/2V+



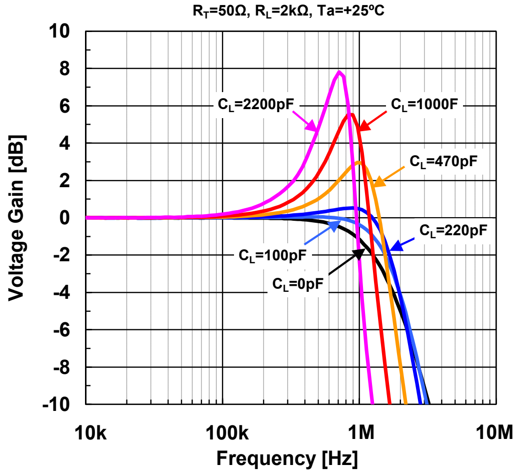
Voltage Gain/Phase vs. Frequency
(correlation with Ta)
V+/V-=±7.0V, A_V=40dB, R_F=10kΩ, R_T=50Ω,
R_L=2kΩ, C_L=0pF, V_{IN}=-30dBm



Voltage Gain/Phase vs. Frequency
V+/V-=±5.0V, G_V=40dB, R_F=10kΩ, R_T=50Ω,
R_L=2kΩ, C_L=0pF, V_{IN}=-30dBm



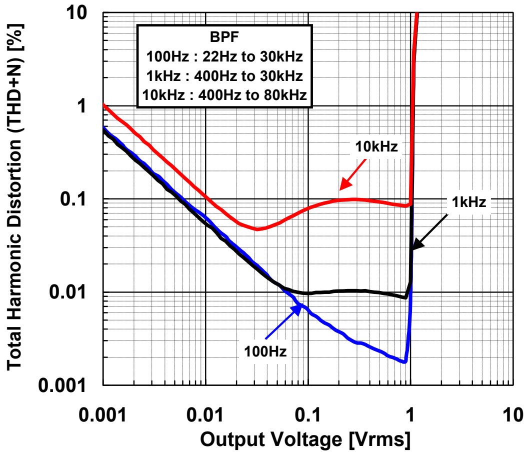
Voltage Gain vs. Frequency
(with Capacitance Load)
V+/V-=±2.5V, G_V=0dB
R_T=50Ω, R_L=2kΩ, Ta=+25ºC



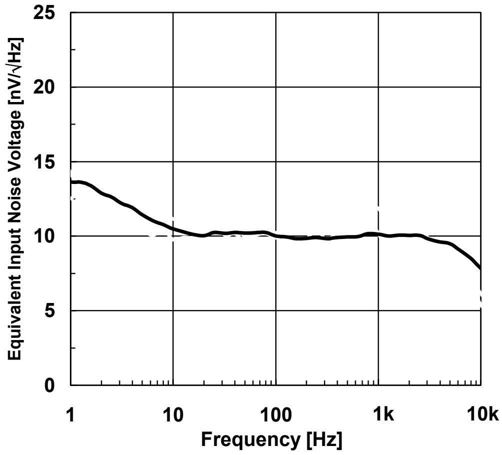
■ TYPICAL CHARACTERISTICS

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

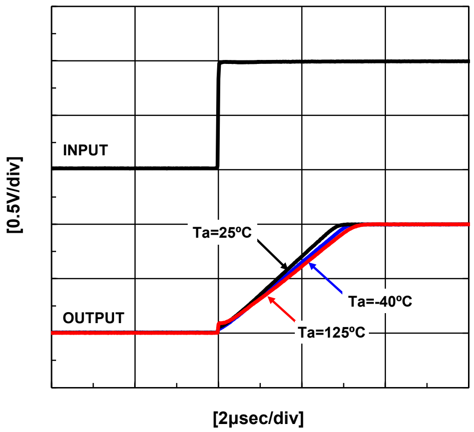
Total Harmonic Distortion vs. Output Voltage
$V^+/V^-=\pm1.5V$, $G_V=6dB$, $R_L=2k\Omega$ to 0V, $C_L=0pF$, Ta=25°C



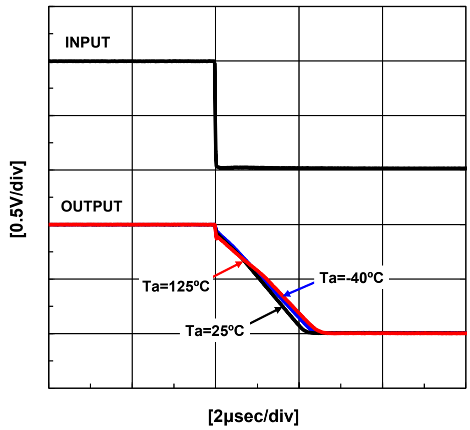
Equivalent Input Noise Voltage vs. Frequency
$V^+/V^-=\pm2.5V$, $G_V=40dB$, $R_L=2k\Omega$, $C_L=0pF$, Ta=25°C



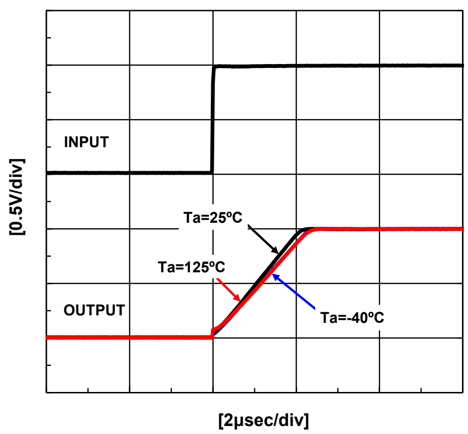
Pulse Response (Rise)
$V^+/V^-=\pm2.5V$, $V_{IN}=1V_{P-P}$, f=10kHz
Gv=0dB, $R_L=10k\Omega$ to GND, $C_L=0pF$



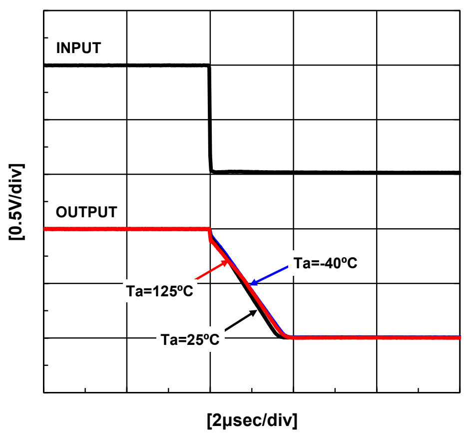
Pulse Response (Fall)
$V^+/V^-=\pm2.5V$, $V_{IN}=1V_{P-P}$, f=10kHz
Gv=0dB, $R_L=10k\Omega$ to GND, $C_L=0pF$



Pulse Response (Rise)
$V^+/V^-=\pm7.0V$, $V_{IN}=1V_{P-P}$, f=10kHz
Gv=0dB, $R_L=10k\Omega$ to GND, $C_L=0pF$



Pulse Response (Fall)
$V^+/V^-=\pm7.0V$, $V_{IN}=1V_{P-P}$, f=10kHz
Gv=0dB, $R_L=10k\Omega$ to GND, $C_L=0pF$



■ REVISION HISTORY

Date	Revision	Changes
May 24, 2023	Ver.4.0	Changed Datasheet format. Correction of errors Unity Gain Bandwidth -> Gain Bandwidth Product GB -> GBW VNI -> en

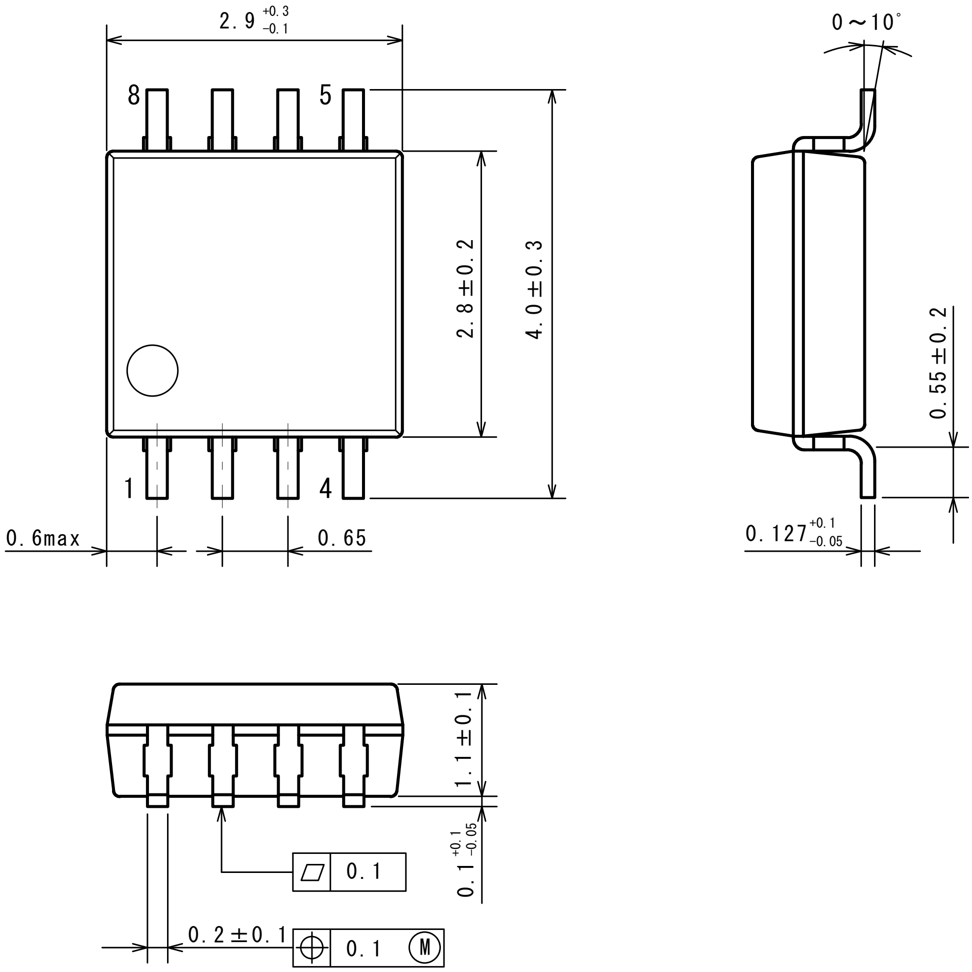
Nisshinbo Micro Devices Inc.

MSOP8 (VSP8)

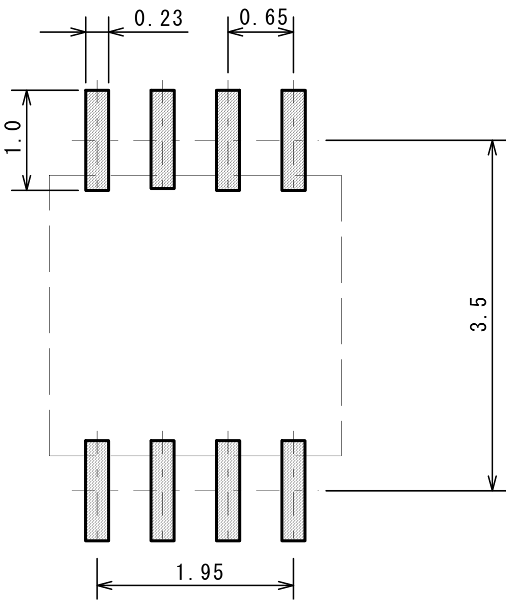
PI-VSP8-E-B

■ **PACKAGE DIMENSIONS**

UNIT: mm



■ **EXAMPLE OF SOLDER PADS DIMENSIONS**



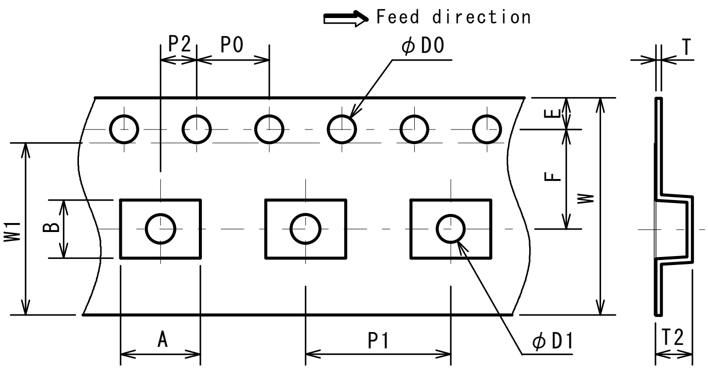
Nisshinbo Micro Devices Inc.

MSOP8 (VSP8)

■ PACKING SPEC

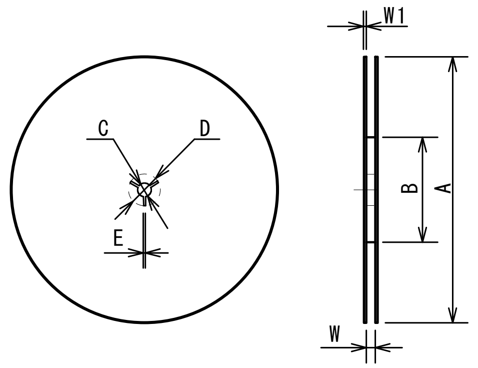
UNIT: mm

TAPING DIMENSIONS



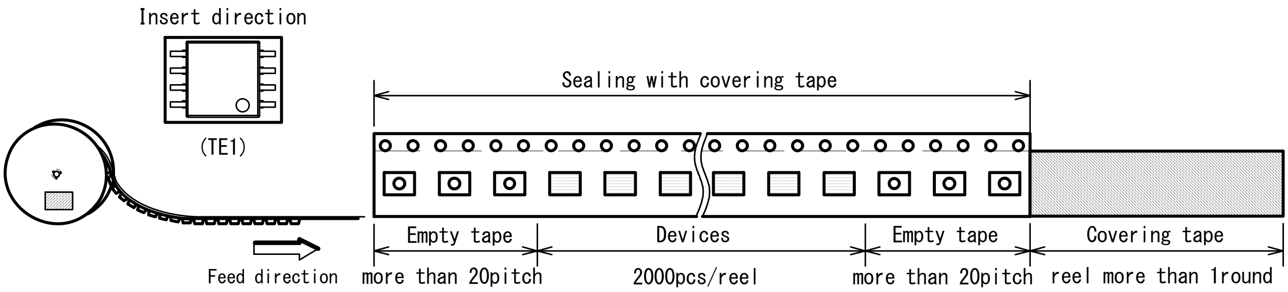
SYMBOL	DIMENSION	REMARKS
A	4.4	BOTTOM DIMENSION
B	3.2	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{0}$	
D1	$1.5^{+0.1}_{0}$	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	2.0 (MAX.)	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

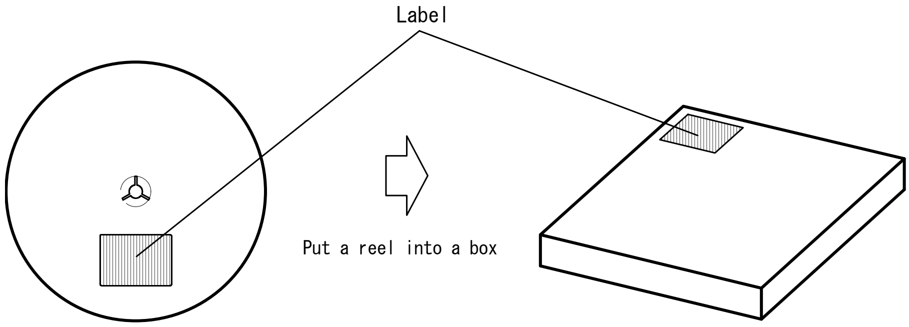


SYMBOL	DIMENSION
A	φ254±2
B	φ100±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13.5±0.5
W1	2.0±0.2

TAPING STATE



PACKING STATE



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    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

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    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.

    8-3. Remedies after Quality Warranty Period

    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
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