



## NJM8830

### Ultralow Distortion, Ultralow Noise, Rail-to-Rail Output Dual Audio Operational Amplifier

#### FEATURES

- ( $V^+ / V^- = \pm 5V$ , Typical value,  $T_a = 25^\circ C$ )
- Ultralow Distortion 0.000012% typ. at  $f=1kHz$
  - Ultralow Noise 2.5nV/ $\sqrt{Hz}$  typ. at  $f=1kHz$
  - Wide Gain Bandwidth Product 90MHz typ.
  - High Slew Rate 30V/ $\mu s$  typ
  - High Output Current 100mA typ.
  - Operating Voltage  $\pm 2.0V$  to  $\pm 5.25V$
  - Supply Current 6.5mA typ. (Dual)
  - Rail-to-Rail Output
  - Bipolar Input
  - Package Outline HSOP8-M1  
DFN8-W1 (ESON8-W1)

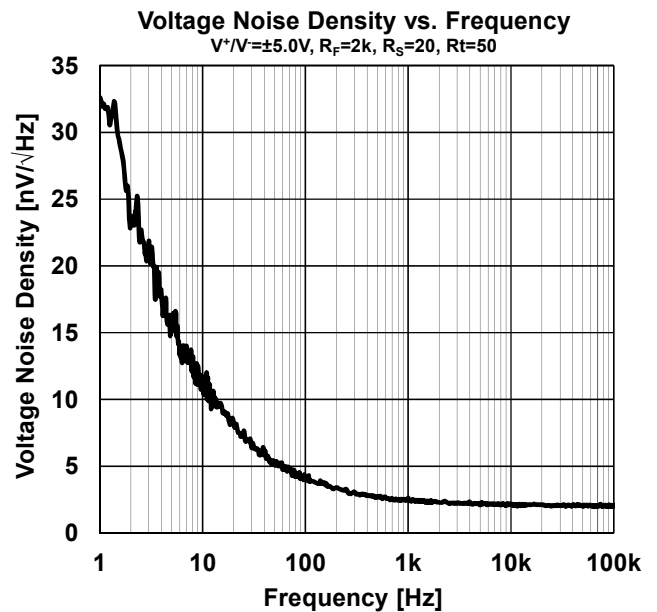
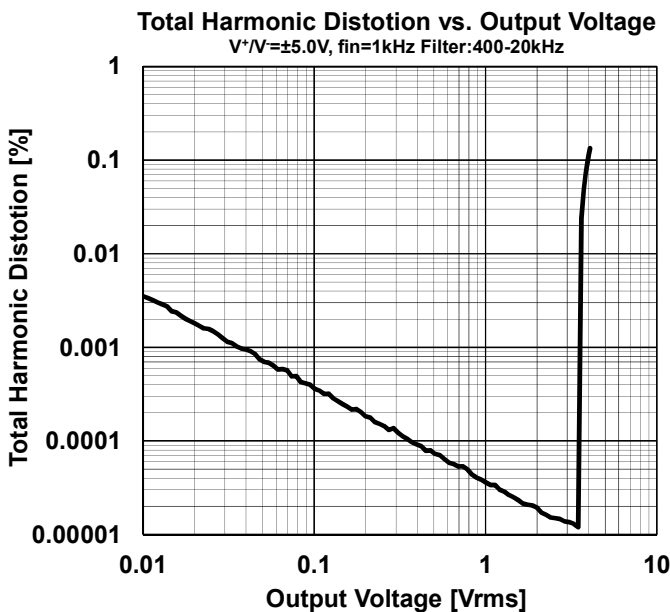
#### DESCRIPTION

The NJM8830 is a ultralow distortion ultralow noise Rail-to-Rail output dual audio operational amplifier. The NJM8830 features ultralow distortion, ultralow noise, wide bandwidth, high slew rate, high output current and small package. It is the best for audio preamplifiers, active filters, microphone amplifiers, line amplifiers and headphone amplifiers.

#### APPLICATIONS

- Portable Audio
- Home Audio
- Professional Audio
- Car Audio

#### THD and Noise



■ PRODUCT NAME INFORMATION

NJM8830 aaa (bbb)

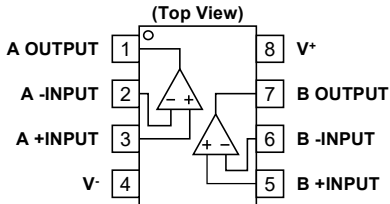
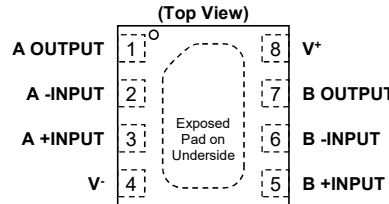
Description of configuration

Suffix	Item	Description
aaa	Package code	Indicates the package. Refer to the order information.
bbb	Packing	Refer to the packing specifications.

■ ORDER INFORMATION

Product Name	Package	RoHS	Halogen-Free	Terminal Finish	Marking	Weight (mg)	MOQ (pcs)
NJM8830GM1 (TE1)	HSOP8-M1	Yes	Yes	Pure Sn	8830	81	3000
NJM8830KW1 (TE3)	DFN8-W1 (ESON8-W1)	Yes	Yes	Sn2Bi	8830	18	1500

■ PIN DESCRIPTIONS

Product Name	NJM8830GM1	NJM8830KW1
Package	HSOP8-M1	DFN8-W1 (ESON8-W1)
Pin Functions	 <p>(Top View)</p> <p>A OUTPUT 1, A -INPUT 2, A +INPUT 3, V- 4, V+ 8, B OUTPUT 7, B -INPUT 6, B +INPUT 5</p> <p>Connect to exposed pad to V-</p>	 <p>(Top View)</p> <p>A OUTPUT 1, A -INPUT 2, A +INPUT 3, V- 4, V+ 8, B OUTPUT 7, B -INPUT 6, B +INPUT 5</p> <p>Exposed Pad on Underside</p> <p>Connect to exposed pad to V-</p>

Pin No.	Pin Name	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
4	V-	-	Negative supply or Ground (single supply)
5	B +INPUT	I	Non-inverting input channel B
6	B -INPUT	I	Inverting input channel B
7	B OUTPUT	O	Output channel B
8	V+	-	Positive supply

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit
Supply Voltage	V <sup>+</sup> / V <sup>-</sup>	±5.5	V
Input Voltage *1	V <sub>IN</sub>	±5.5	V
Differential Input Voltage *2	V <sub>ID</sub>	±4.0	V
Output Peak Current	I <sub>OP</sub>	150	mA
Power Dissipation (Ta = 25°C) HSOP8-M1 DFN8-W1 (ESON8-W1)	P <sub>D</sub>	2-Layer / 4-Layer 720 *3 / 2500 *4 650 *3 / 2100 *4	mW
Storage Temperature	T <sub>stg</sub>	-50 to 150	°C
Junction Temperature	T <sub>J</sub>	150	°C

\*1 Supply voltages less than ±5.5V, the maximum input voltage is equal to the supply voltage.

\*2 Differential voltage is the voltage difference between +INPUT and -INPUT.

Supply voltages less than ±2.0V, the differential input voltage is equal to the supply voltage.

\*3 2-Layer: Mounted on glass epoxy board (101.5 mm × 114.5 mm × 1.6 mm: based on EIA/JEDEC standard, 2-layer FR-4) with exposed pad.

\*4 4-Layer: Mounted on glass epoxy board (101.5 mm × 114.5 mm × 1.6 mm: based on EIA/JEDEC standard, 4-layer FR-4) with exposed pad.

(For 4-layer: Applying 99.5 mm × 99.5 mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5.)

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 (θ <sub>ja</sub> )	Thermal Characterization Parameter (ψ <sub>jt</sub> )	
HSOP8-M1	158 *5 / 50 *6	28 *5 / 12 *6	°C/W
DFN8-W1 (ESON8-W1)	192 *5 / 60 *6	-	

θ<sub>ja</sub>: Junction-to-Ambient Thermal Resistance

ψ<sub>jt</sub>: Junction-to-Top Thermal Characterization Parameter

\*5 2-Layer: Mounted on glass epoxy board (101.5 mm × 114.5 mm × 1.6 mm: based on EIA/JEDEC standard, 2-layer FR-4) with exposed pad.

\*6 4-Layer: Mounted on glass epoxy board (101.5 mm × 114.5 mm × 1.6 mm: based on EIA/JEDEC standard, 4-layer FR-4) with exposed pad.

(For 4-layer: Applying 99.5 mm × 99.5 mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5.)

■ ELECTROSTATIC DISCHARGE (ESD) PROTECTION VOLTAGE

Parameter	Conditions	Protection Voltage
HBM	C = 100 pF, R = 1.5 kΩ	±1000 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 <sup>+</sup> /V <sup>-</sup>		±2.0 to ±5.25	V
Operating Temperature	T <sub>opr</sub>		-40 to 125	°C

RECOMMENDED OPERATING CONDITIONS
<p>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.</p>

## ■ ELECTRICAL CHARACTERISTICS

$V^+/V^- = \pm 5.0V$ ,  $R_L$  to GND,  $T_a = 25^\circ C$ , unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>DC CHARACTERISTICS</b>						
Supply Current (All Amplifiers)	$I_{CC}$	No Signal, $R_L = \infty$	-	6.5	8.0	mA
Input Offset Voltage	$V_{IO}$	$R_s = 50\Omega$	-	0.5	2.0	mV
Input Bias Current	$I_B$		-	150	700	nA
Input Offset Current	$I_{IO}$		-	10	700	nA
Open-Loop Voltage Gain	$A_V$	$R_L = 10k\Omega$ , $V_O = \pm 3V$	90	120	-	dB
Common Mode Rejection Ratio	CMR	$V_{ICM} = -5.0$ to $+3.5V$ *1	80	110	-	dB
Supply Voltage Rejection Ratio	SVR	$V^+/V^- = \pm 2.0$ to $\pm 5.25V$	90	120	-	dB
Maximum Output Voltage 1	$V_{OM1}$	$R_L = 10k\Omega$	$\pm 4.85$	$\pm 4.95$	-	V
Maximum Output Voltage 2	$V_{OM2}$	$R_L = 600\Omega$	$\pm 4.8$	$\pm 4.85$	-	V
Common Mode Input Voltage Range	$V_{ICM}$	CMR $\geq 80$ dB	-5.0	-	3.5	V
Output Source Current	$I_{SOURCE}$	$V_O = +2V$	60	100	-	mA
Output Sink Current	$I_{SINK}$	$V_O = -2V$	60	100	-	mA
<b>AC CHARACTERISTICS</b>						
Gain Bandwidth Product	GBW	$f = 100kHz$	-	90	-	MHz
Unity Gain Frequency	$f_T$	$A_V = +100$ , $R_S = 100\Omega$ , $R_L = 2k\Omega$ , $C_L = 10pF$	-	60	-	MHz
Phase Margin	$\Phi_M$	$A_V = +100$ , $R_S = 100\Omega$ , $R_L = 2k\Omega$ , $C_L = 10pF$	-	70	-	Deg
Slew Rate	SR	$A_V = 1$ , $V_{IN} = 2V_{p-p}$ , $R_L = 2k\Omega$ , $C_L = 10pF$	-	30	-	V/ $\mu s$
Channel Separation	CS	$f = 1kHz$	-	130	-	dB
Total Harmonic Distortion	THD	$f = 1kHz$ , Test circuit Figure 12.	-	0.000012	-	%
Input Noise Voltage1	$e_n$	$f = 1kHz$	-	2.5	-	nV/ $\sqrt{Hz}$
Input Noise Voltage2	$V_{NI}$	$f = 20Hz$ to $20kHz$	-	0.34	-	$\mu V_{rms}$

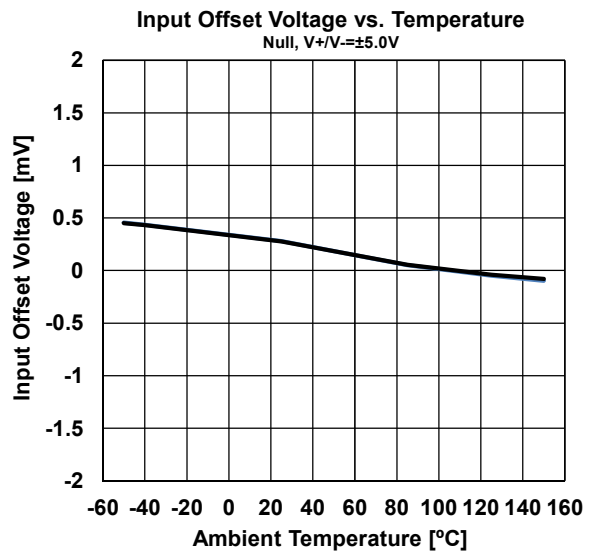
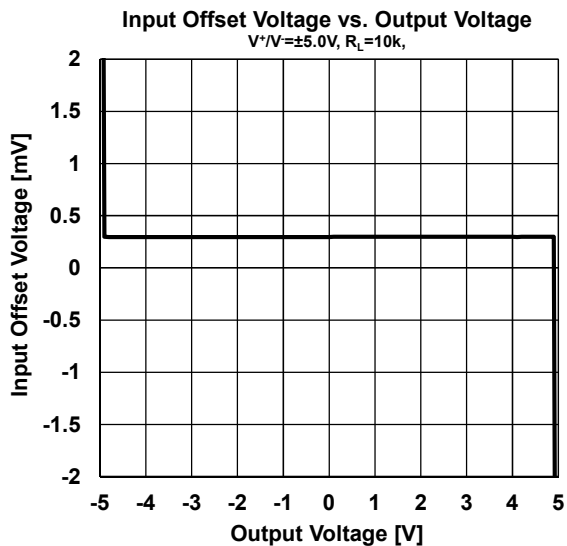
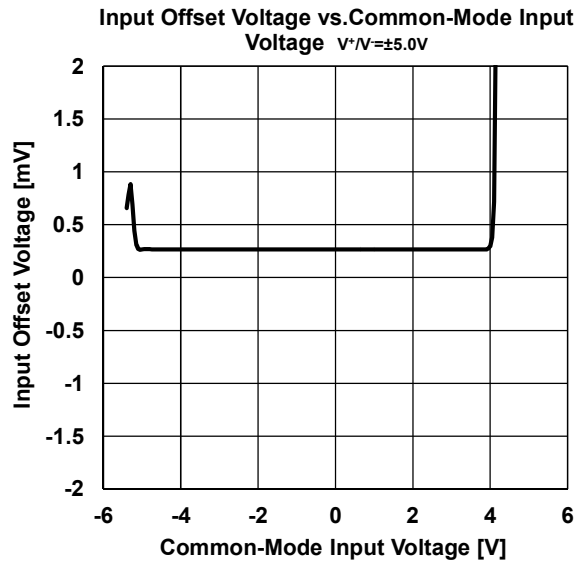
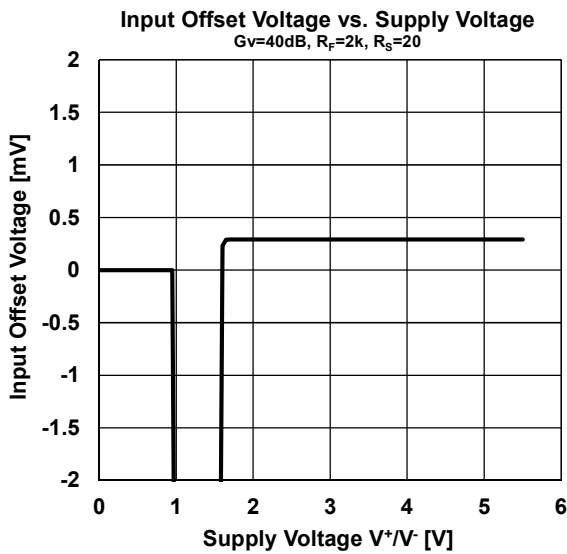
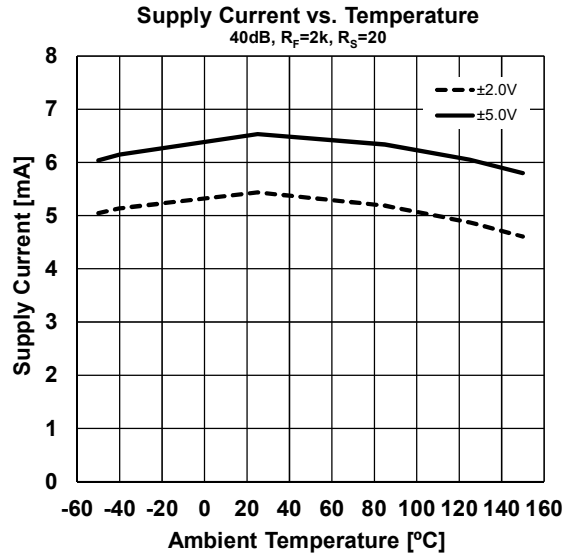
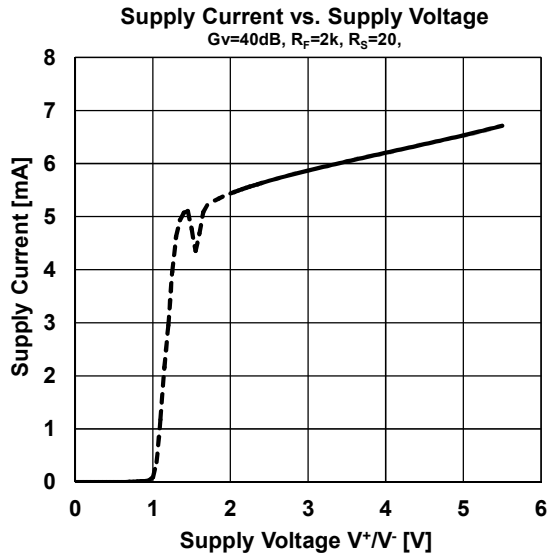
\*1 CMR is calculated by specified change in offset voltage. ( $V_{ICM} = 0V$  to  $+3.5V$ ,  $V_{ICM} = 0V$  to  $-5V$ )

## ■ NOTE

The closed gain should be 6dB or higher to prevent the oscillation. Unity gain follower application may cause the oscillation.

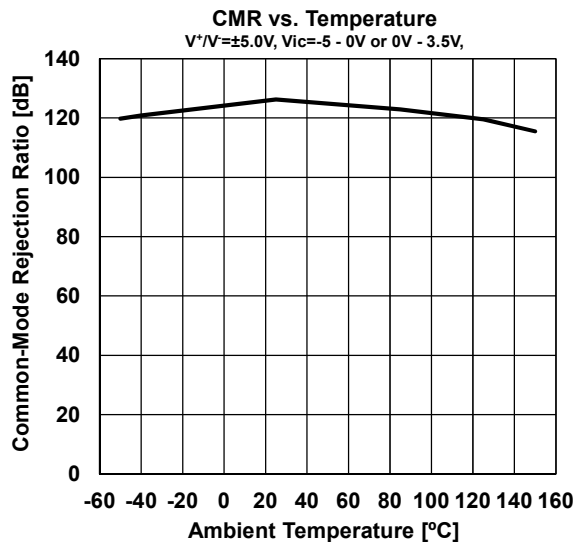
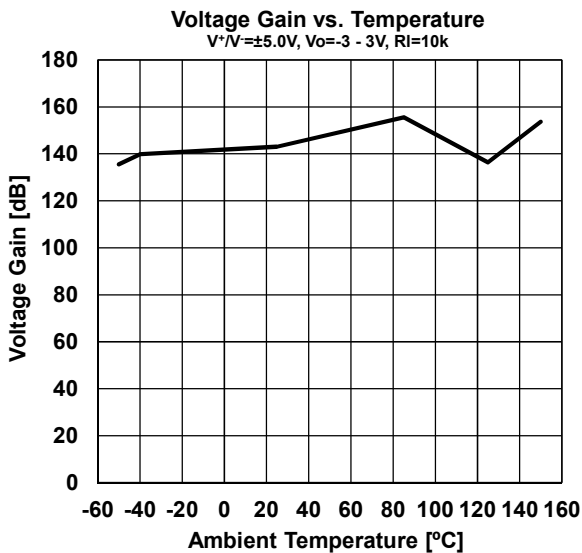
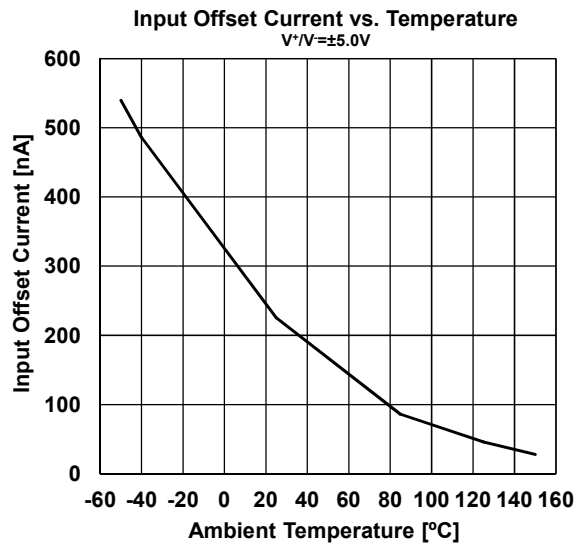
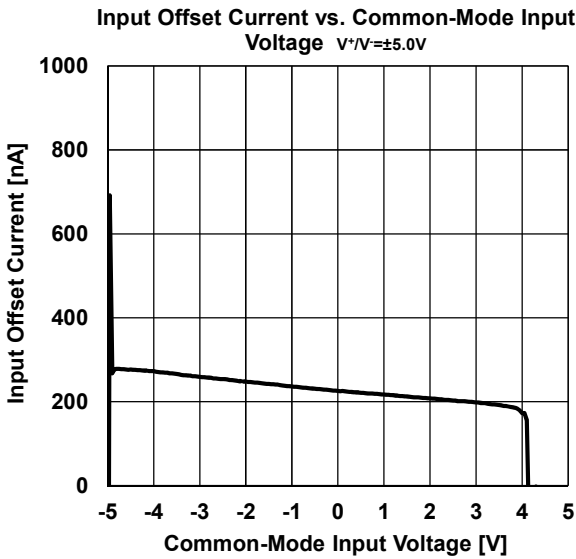
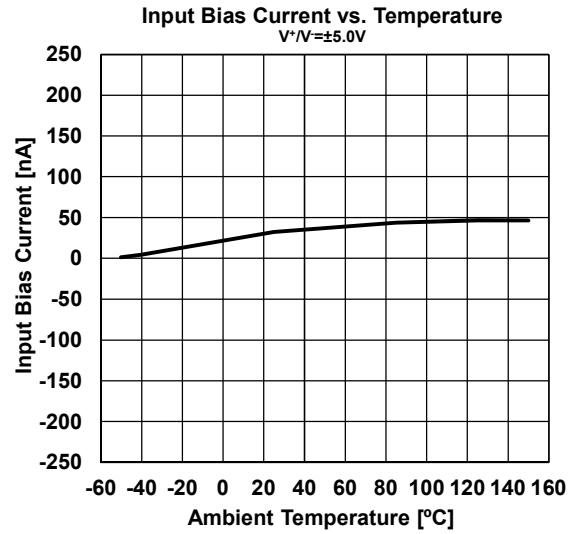
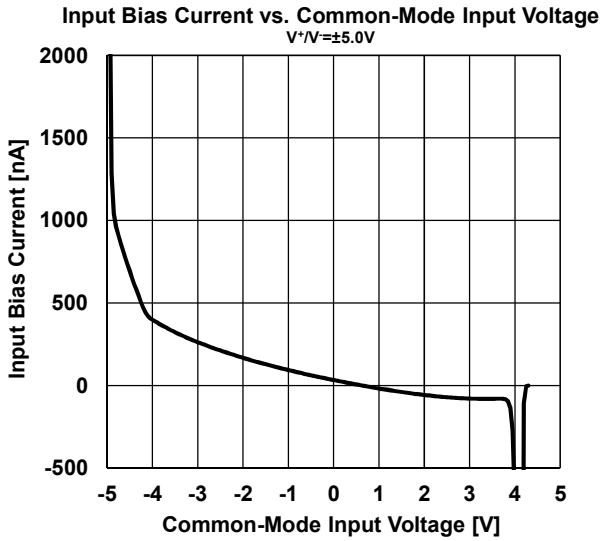
■ TYPICAL CHARACTERISTICS

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



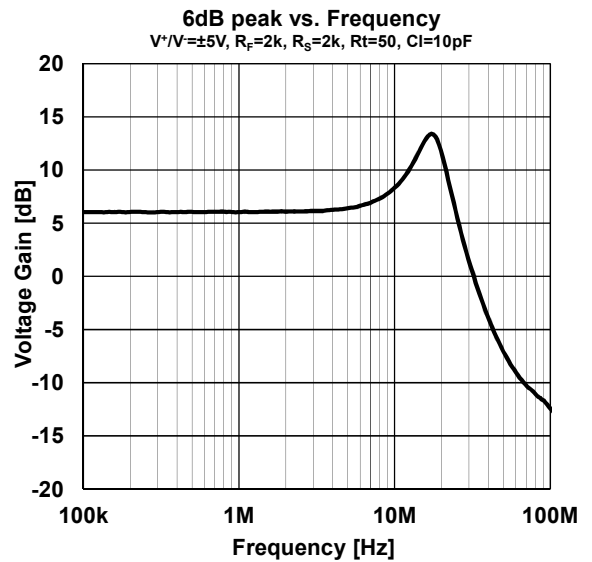
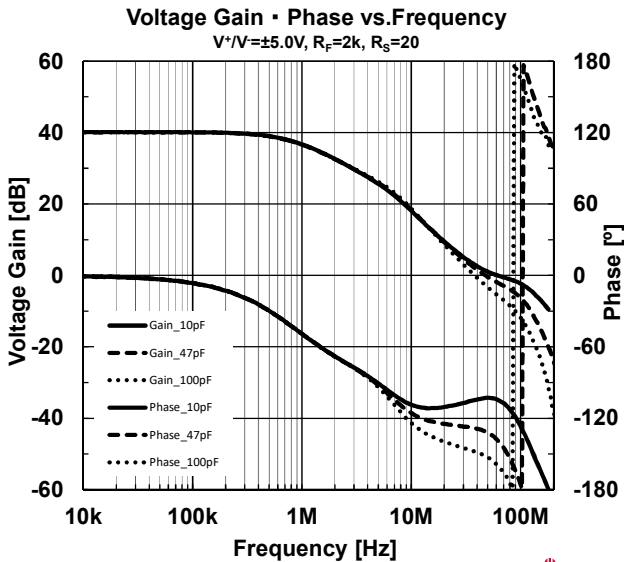
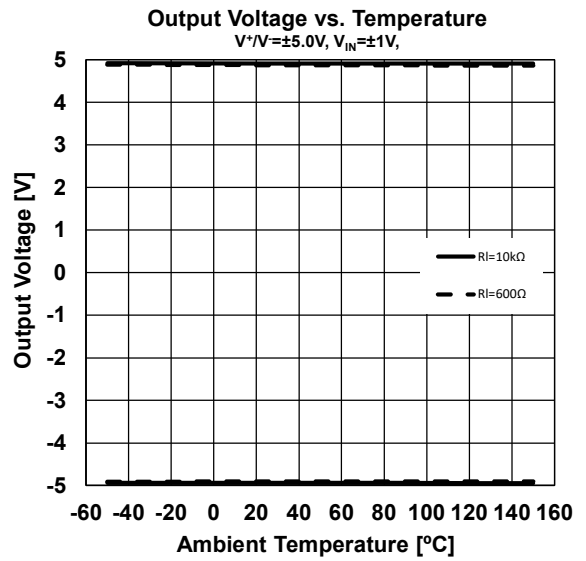
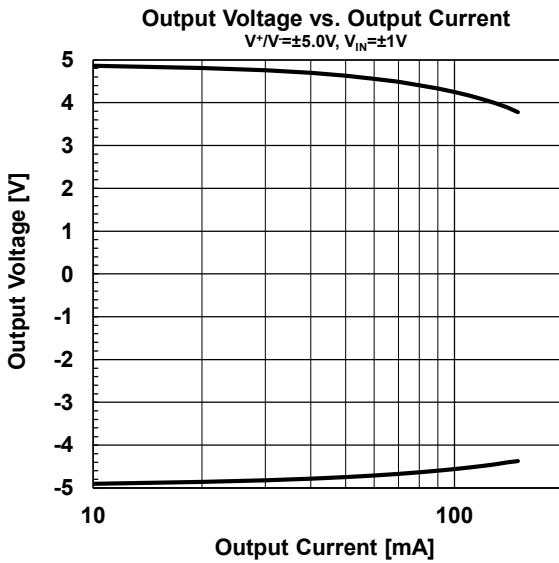
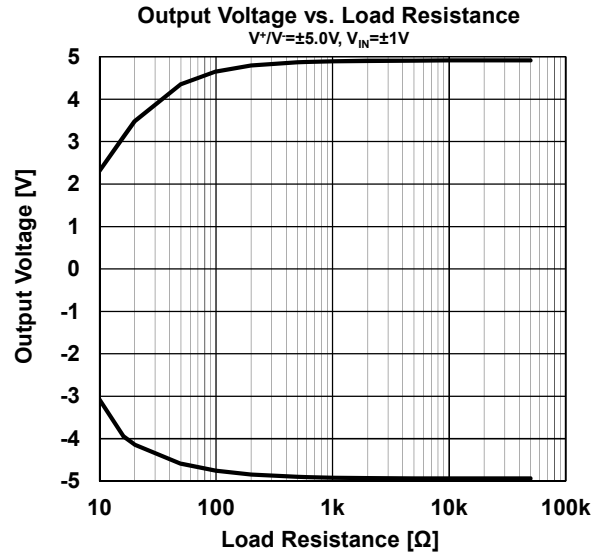
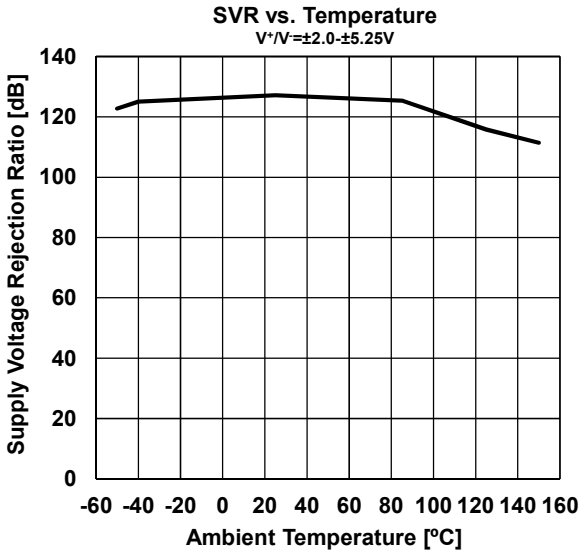
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■ TYPICAL CHARACTERISTICS

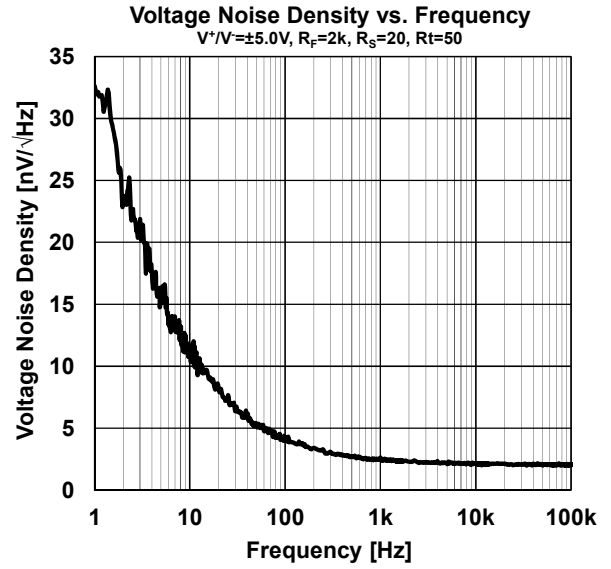
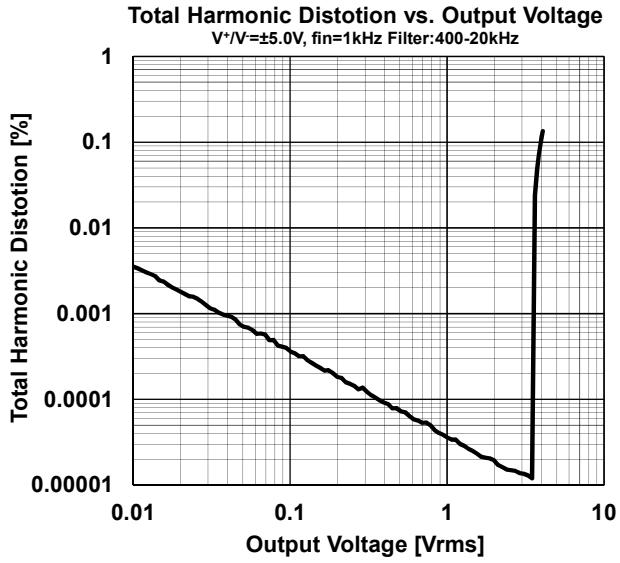
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.





■ TYPICAL CHARACTERISTICS

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



■ TEST CIRCUITS

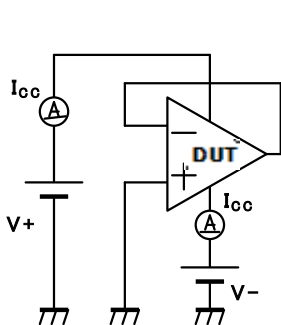


Figure1. Supply Current

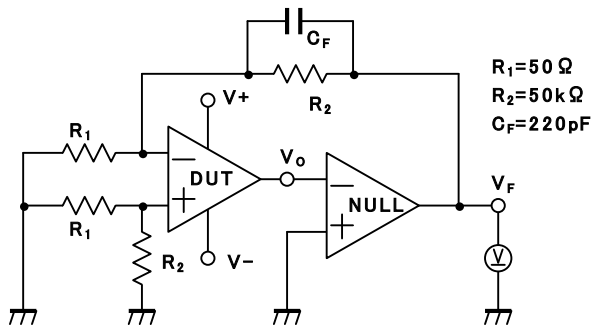


Figure2. Input Offset Voltage

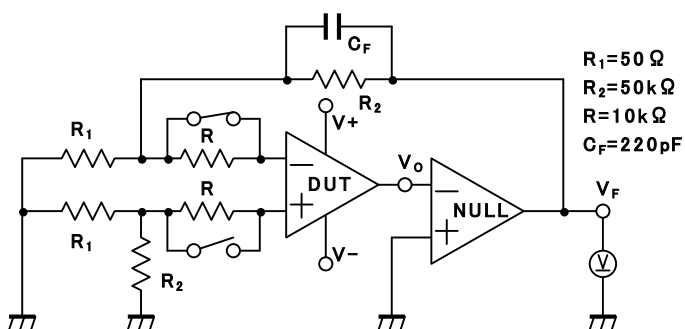


Figure3. Input Bias Current

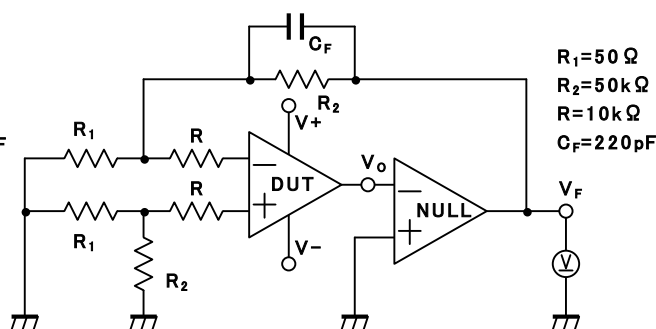


Figure4. Input Offset Current

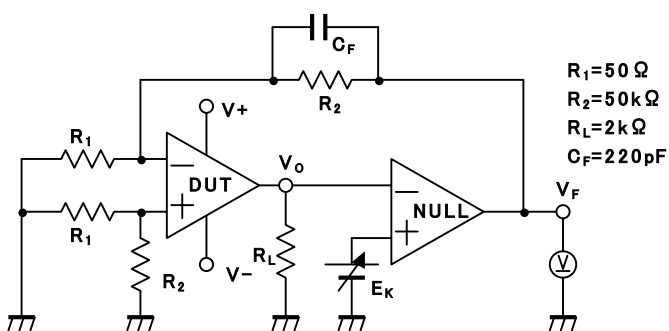


Figure5. Open-Loop Voltage Gain

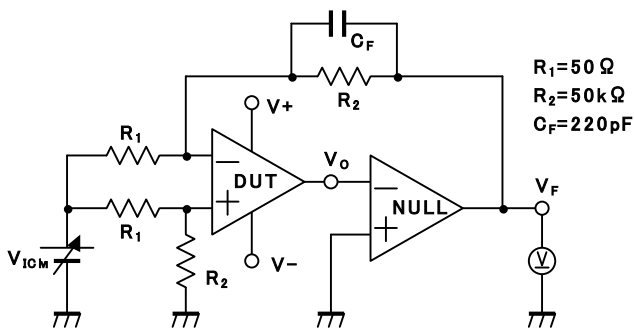


Figure6. Common Mode Rejection Ratio

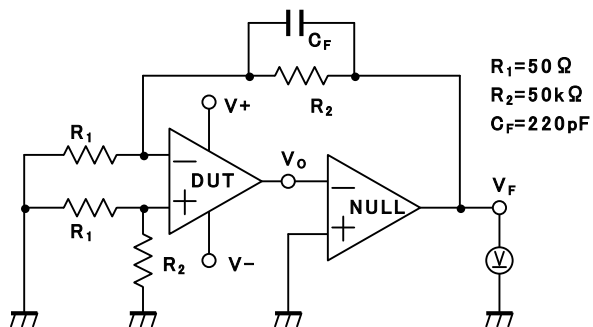


Figure7. Supply Voltage Rejection Ratio

■ TEST CIRCUITS

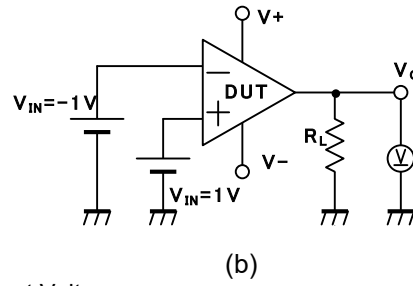
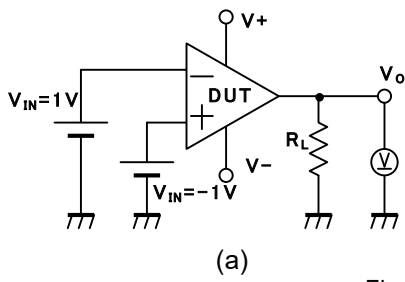


Figure8. Maximum Output Voltage

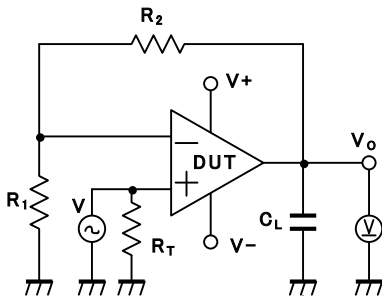


Figure9. Gain Bandwidth Product

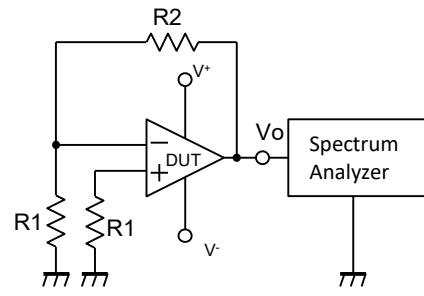


Figure10. Input Noise Voltage

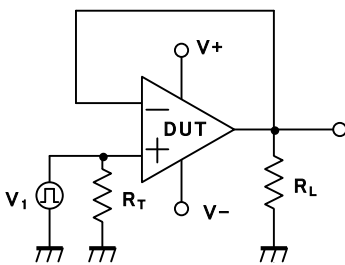


Figure11. Slew Rate

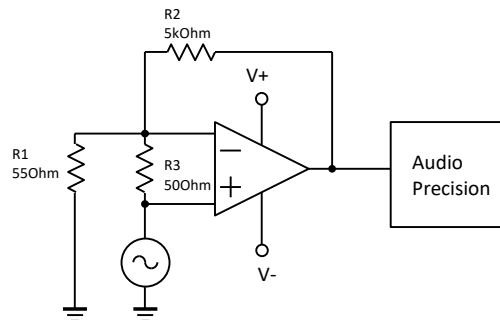


Figure12. Total Harmonic Distortion

■ REVISION HISTORY

DATE	REVISION	CHANGES
May 20, 2022	Ver.1.0	Initial Release

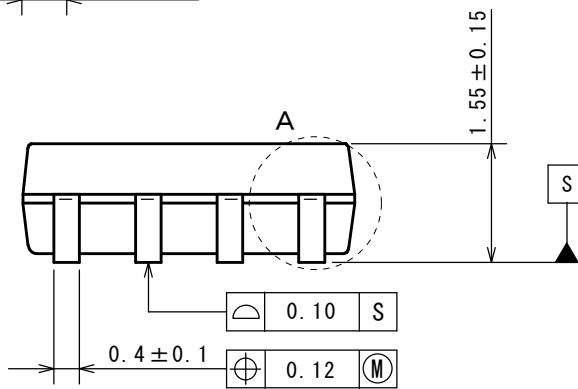
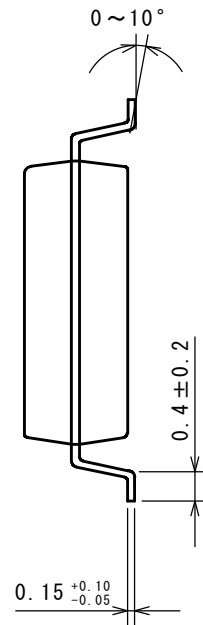
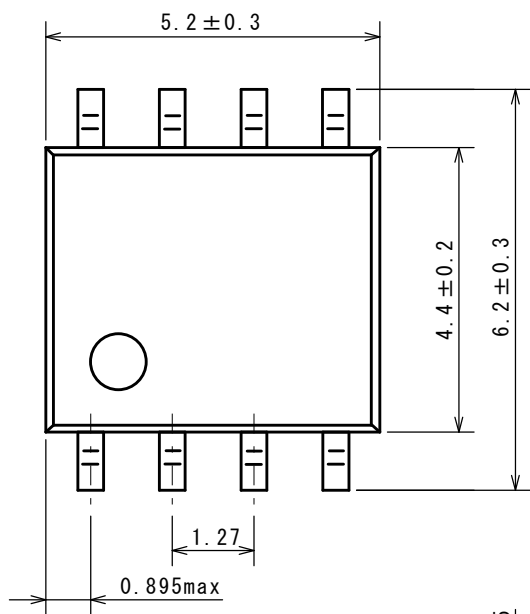
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HSOP8-M1

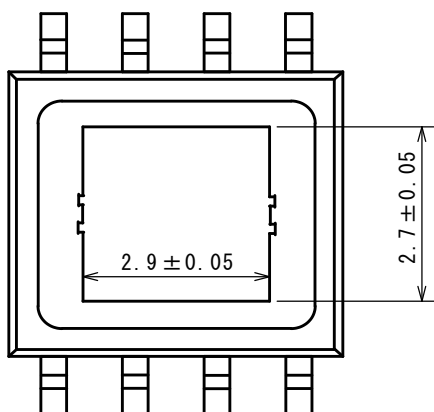
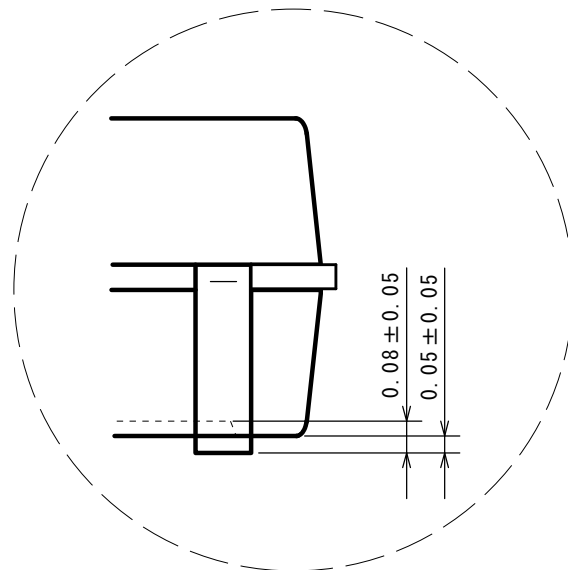
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## ■ PACKAGE DIMENSIONS

UNIT: mm



Detail drawing of part A

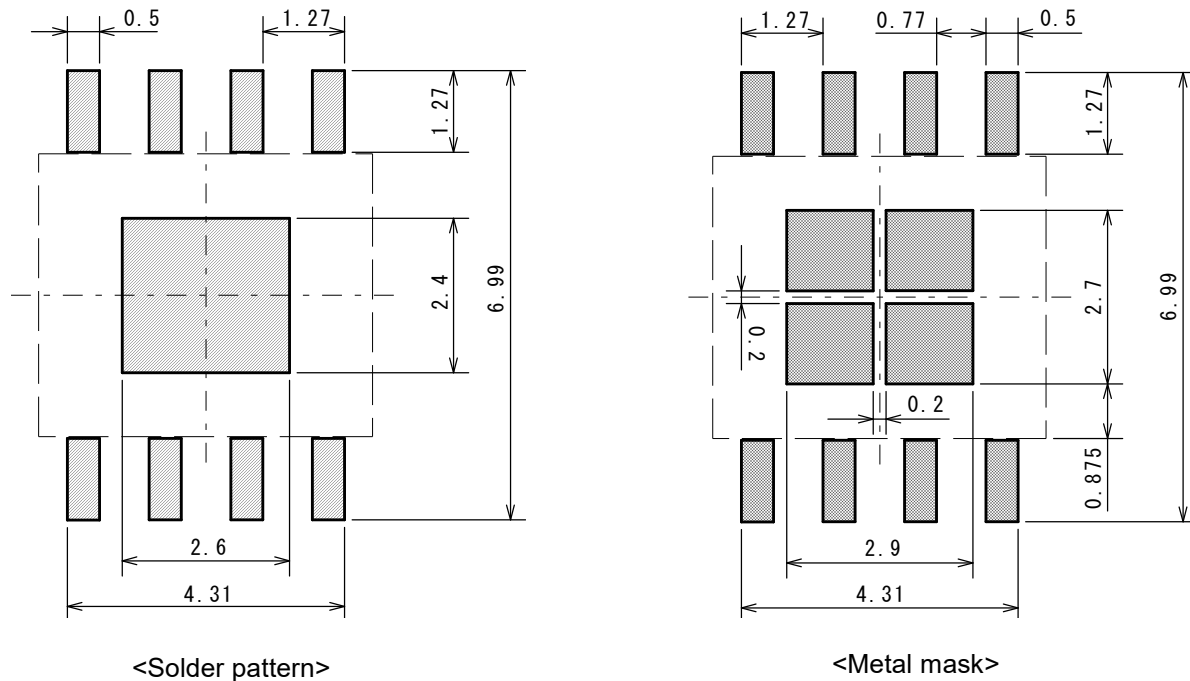


## Nisshinbo Micro Devices Inc.

HSOP8-M1

PI-HSOP8-M1-E-A

## ■ EXAMPLE OF SOLDER PADS DIMENSIONS



## &lt;Instructions for mounting&gt;

Please note the following points when you mount HSOP-8 package IC because there is a standoff on the backside electrode.

- (1) Temperature profile of lead and backside electrode.  
It is necessary that both re-flow temperature profile of lead and backside electrode are higher than preset temperature. When solder wet temperature is lower than lead/backside electrode temperature, there is possibility of defect mounting.
- (2) Design of foot pattern / metal mask  
Metal mask thickness of solder pattern print is more than 0.13mm.
- (3) Solder paste  
The mounting was evaluated with following solder paste, foot pattern and metal mask.  
Because mounting might be greatly different according to the manufacturer and the product number even if the solder composition is the same.  
We will strongly recommend to evaluate mounting previously with using foot pattern, metal mask and solder paste.

Solder paste composition	Sn37Pb (Senju Metal Industry Co., Ltd: OZ7053-340F-C)
	Sn3Ag0.5Cu (Senju Metal Industry Co., Ltd: M705-GRN350-32-11)

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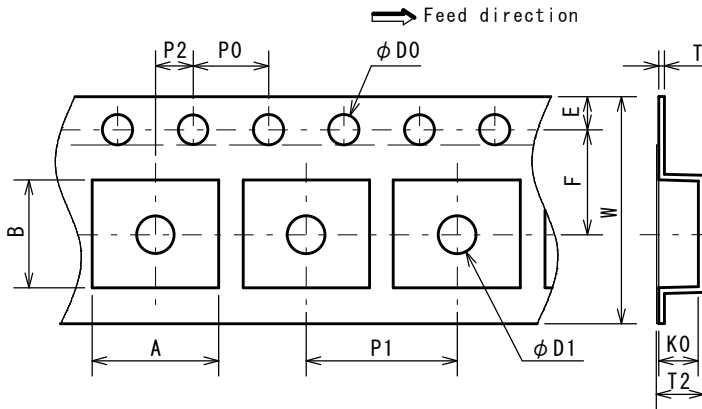
HSOP8-M1

PI-HSOP8-M1-E-A

■ PACKING SPEC

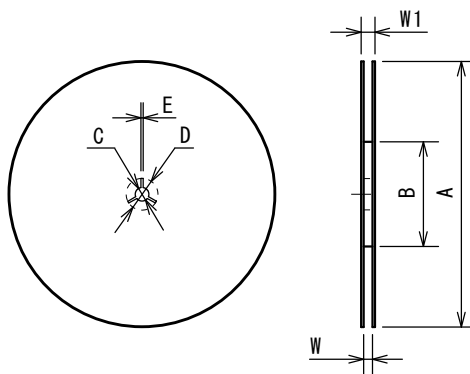
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TAPING DIMENSIONS



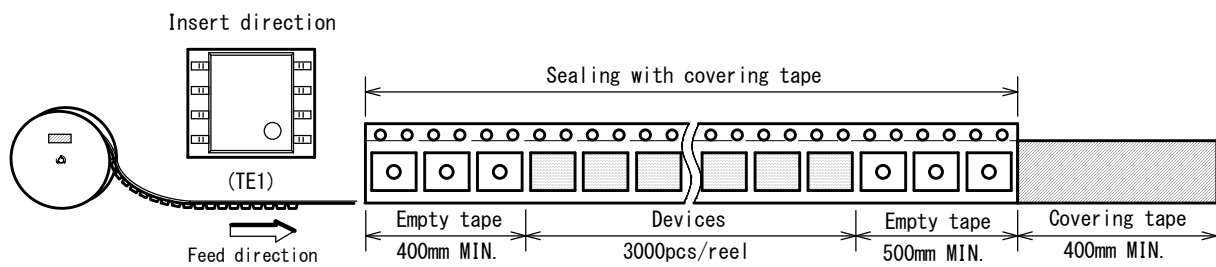
SYMBOL	DIMENSION	REMARKS
A	6.7±0.1	
B	5.55±0.1	
D0	1.55±0.05	
D1	2.05±0.05	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.3±0.05	
T2	2.47	
K0	2.1±0.1	
W	12.0±0.2	

REEL DIMENSIONS

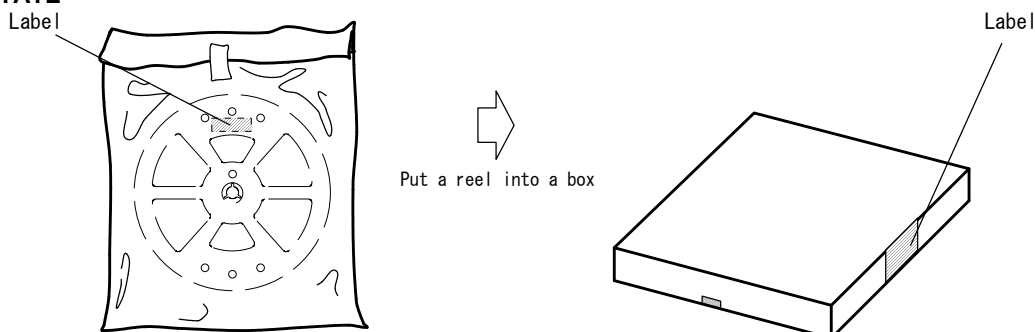


SYMBOL	DIMENSION
A	φ 330±2
B	φ 80±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13.5±0.5
W1	17.5±1

TAPING STATE

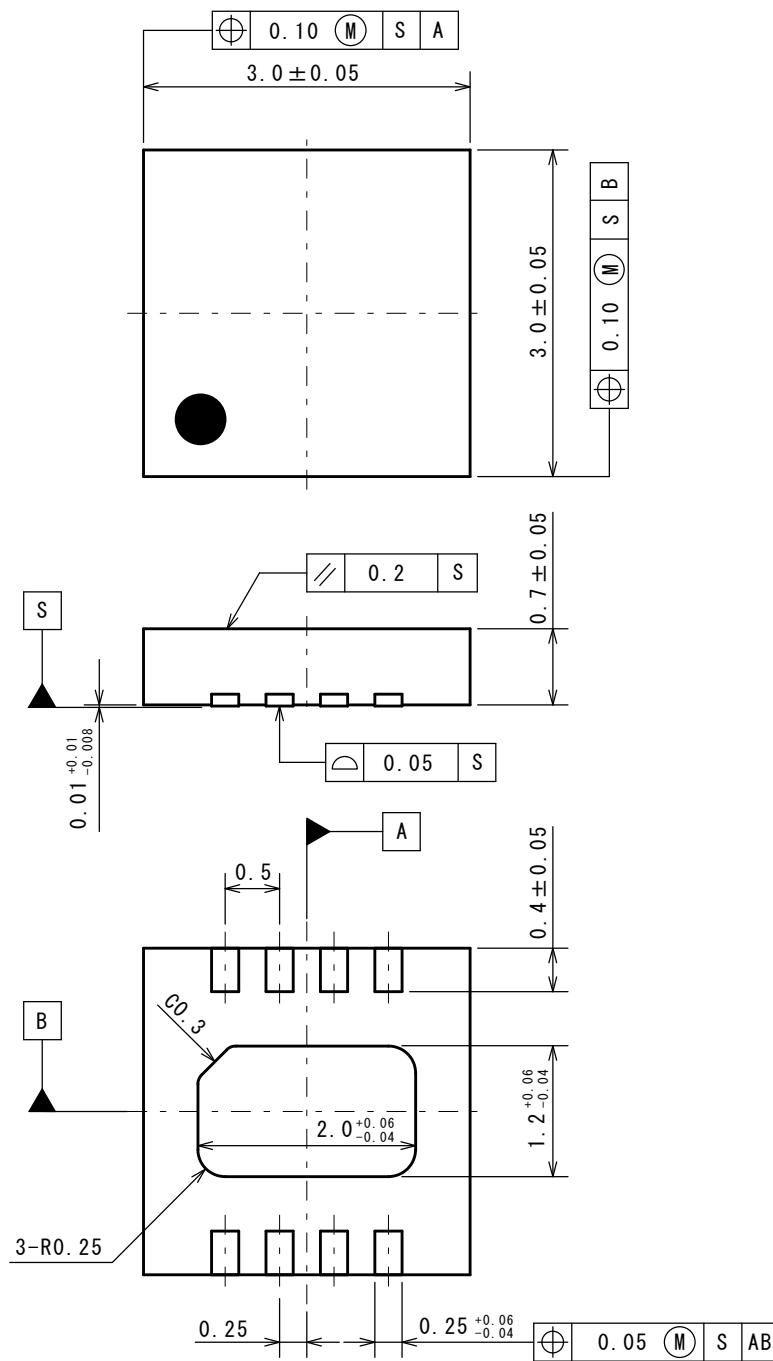


PACKING STATE



■ PACKAGE DIMENSIONS

UNIT: mm





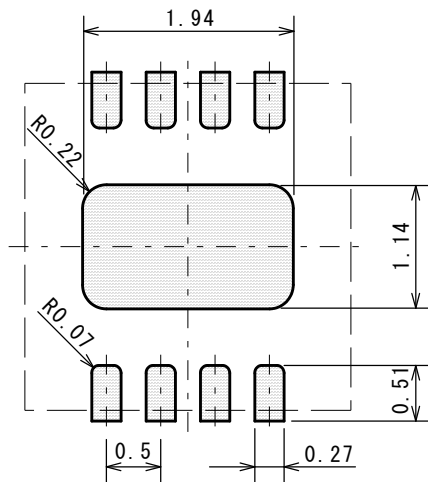
# Nisshinbo Micro Devices Inc.

DFN8-W1

PI-DFN8-W1-E-A

■ EXAMPLE OF SOLDER PADS DIMENSIONS

UNIT: mm



# Nisshinbo Micro Devices Inc.

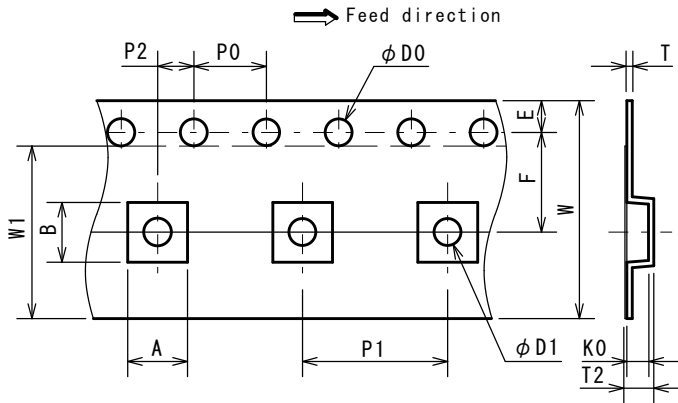
DFN8-W1

PI-DFN8-W1-E-A

■ PACKING SPEC

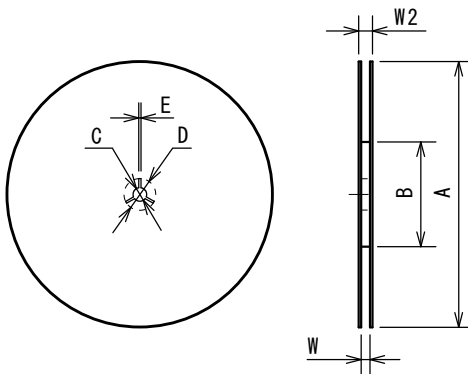
UNIT: mm

TAPING DIMENSIONS



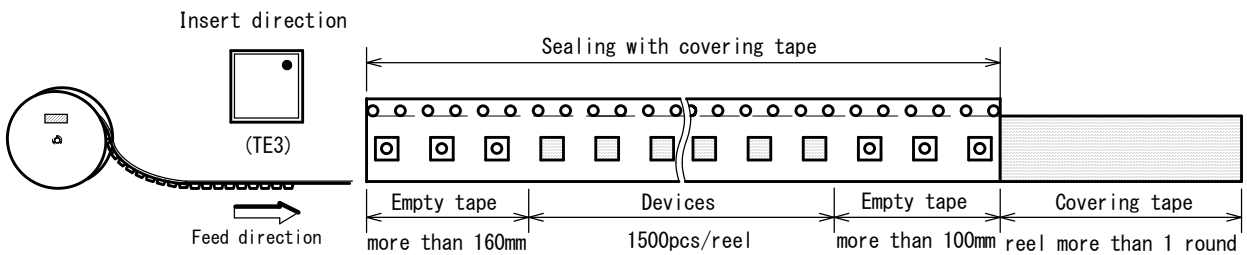
SYMBOL	DIMENSION	REMARKS
A	3.3±0.1	BOTTOM DIMENSION
B	3.3±0.1	BOTTOM DIMENSION
D0	1.5 <sup>+0.1</sup> <sub>0</sub>	
D1	1.5 <sup>+0.1</sup> <sub>0</sub>	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	1.3±0.07	
K0	0.9±0.05	
W	12.0 <sup>+0.3</sup> <sub>-0.1</sub>	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

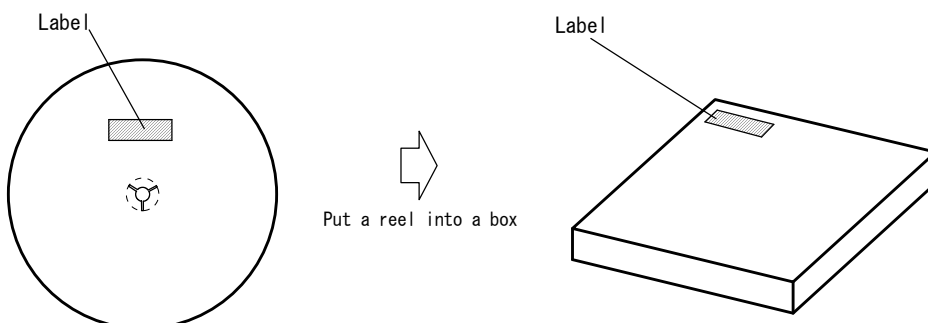


SYMBOL	DIMENSION
A	φ 180 <sup>0</sup> <sub>-3</sub>
B	φ 60 <sup>+1</sup> <sub>0</sub>
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13 <sup>+1</sup> <sub>0</sub>
W2	15.4±1.0

TAPING STATE



PACKING STATE



1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to our sales representatives for the latest information thereon.
2. The materials in this document may not be copied or otherwise reproduced in whole or in part without the prior written consent of us.
3. This product and any technical information relating thereto are subject to complementary export controls (so-called KNOW controls) under the Foreign Exchange and Foreign Trade Law, and related politics ministerial ordinance of the law. (Note that the complementary export controls are inapplicable to any application-specific products, except rockets and pilotless aircraft, that are insusceptible to design or program changes.) Accordingly, when exporting or carrying abroad this product, follow the Foreign Exchange and Foreign Trade Control Law and its related regulations with respect to the complementary export controls.
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5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death should first contact us.
  - Aerospace Equipment
  - Equipment Used in the Deep Sea
  - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
  - Life Maintenance Medical Equipment
  - Fire Alarms / Intruder Detectors
  - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
  - Various Safety Devices
  - Traffic control system
  - Combustion equipment

In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.

6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
8. **Quality Warranty**
  - 8-1. **Quality Warranty Period**

In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
  - 8-2. **Quality Warranty Remedies**

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.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.



**Nisshinbo Micro Devices Inc.**

**Official website**

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