MUSES8920A

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

FEATURES

- High-quality Sound
- Low Noise 8.0nV/√Hz at f=1kHz
- Low Distortion 0.0004% at f=1kHz
- High Slew Rate 25V/μs
- Gain Bandwidth Product 11MHz
- Low Input Bias Current 5pA
- Operating Voltage ±3.5V to ±17V
- J-FET Input
- Bipolar Technology
- Package Outline SOP8 JEDEC 150mil (EMP8)
  DFN8-X7 (ESON8-X7)

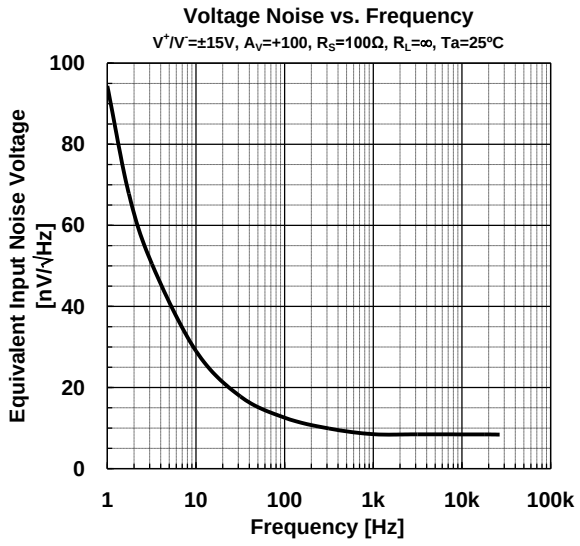
DESCRIPTION

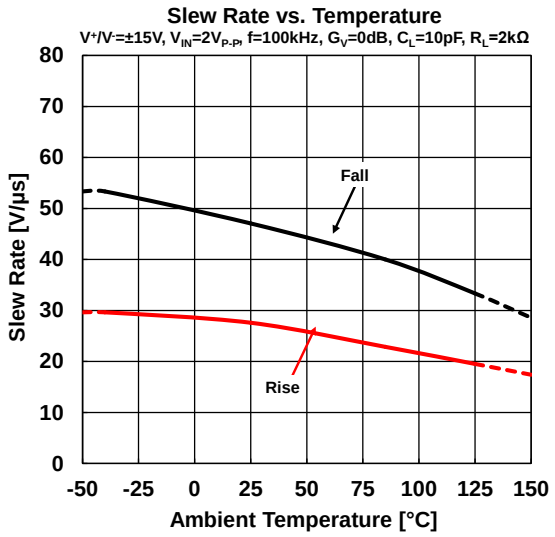
The MUSES8920A is a high-quality sound J-FET input dual operational amplifier, which is optimized for high-end audio, professional audio and portable audio applications.
The MUSES8920A features high-quality sound, low input bias current, low noise, low distortion and high slew rate, and it is suitable for I/V converters, preamplifiers, active filters, headphone amplifiers, and line amplifiers.

APPLICATIONS

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

Voltage Noise and Slew Rate





■ PRODUCT NAME INFORMATION

MUSES8920A aaa (bbb)

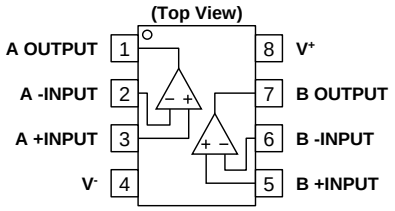
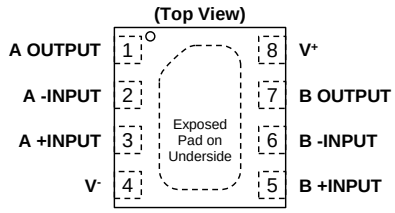
Description of configuration

Suffix	Item	Description
aaa	Package code	Indicates the package. Refer to the order information. E: SOP8 JEDEC 150mil (EMP8) KX7: DFN8-X7(ESON8-X7)
bbb	Packing	Refer to the packing specifications.

■ ORDER INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	PLATING COMPOSITION	WEIGHT (mg)	QUANTITY PER REEL (pcs/reel)
MUSES8920AE(TE1)	SOP8 JEDEC 150mil (EMP8)	✓	✓	Sn2Bi	76	2000
MUSES8920AKX7(TE3)	DFN8-X7 (ESON8-X7)	✓	✓	Sn2Bi	27	1500

■ PIN DESCRIPTIONS

Product Name	MUSES8920AE	MUSES8920AKX7
Package	SOP8 JEDEC 150mil (EMP8)	DFN8-X7 (ESON8-X7)
Pin Functions		

*About Exposed Pad
Floating (Electrical open) or connecting to V-.
Floating (Electrical open) state is recommended when sound quality is important.

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

	Symbol	Rating	Unit
Supply Voltage (Vs = V+ - V−)	V^+/ V^-	±18 (36)	V
Input Voltage *1	V_{IN}	V^- -0.3 to V^- +36.3	V
Differential Input Voltage *2	V_{ID}	±30	V
Power Dissipation (T_a = 25°C) SOP8 JEDEC 150mil (EMP8) DFN8-X7(ESON8-X7)	P_D	2-Layer / 4-Layer 800 *3 / 1200 *4 690 *5 / 2900 *6	mW
Storage Temperature	T_{stg}	-50 to 150	°C
Junction Temperature		150	°C

*1 "Input Voltage" is independent of supply voltage. Normal operating range as operational amplifier is shown in "Common-Mode Input Voltage Range" of "ELECTRICAL CHARACTERISTICS".
*2 “Differential Input Voltage” is the voltage difference between +INPUT and −INPUT.
*3 2-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 2-layer FR-4).
*4 4-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 4-layer FR-4).
*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.)

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 JEDEC 150mil (EMP8) DFN8-X7 (ESON8-X7)	157 *3 / 103 *4 182 *5 / 44 *6	16 *3 / 12 *4 -	°C/W

Θja :Junction-to-Ambient Thermal Resistance
ψjt:Junction-to-Top Thermal Characterization Parameter
*3 2-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 2-layer FR-4).
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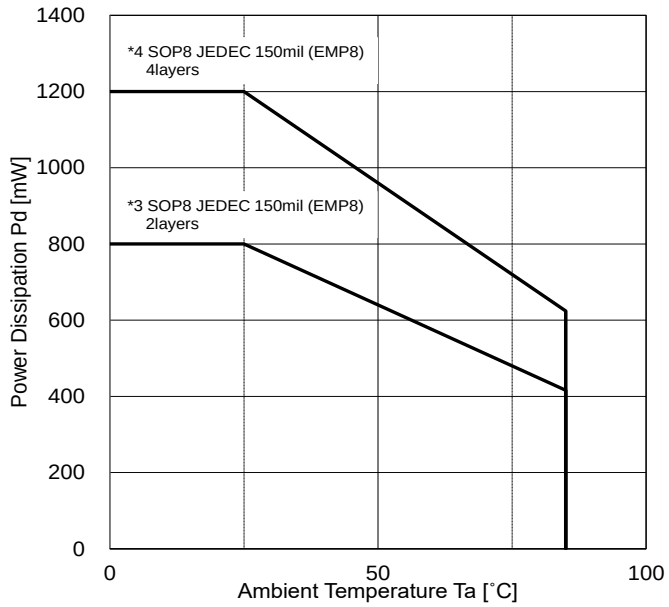
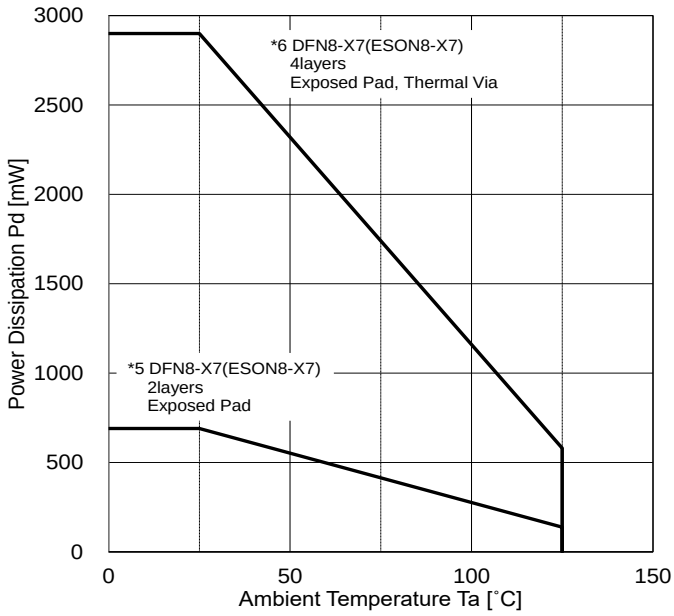
■ POWER DISSIPATION vs. AMBIENT TEMPERATURE





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■ ELECTROSTATIC DISCHARGE (ESD) PROTECTION VOLTAGE

	Conditions	Protection Voltage
HBM	C = 100 pF, R = 1.5 kΩ	±1000 V
CDM	DI-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

	Symbol	Rating	Unit
Supply Voltage	V^+/ V^-	±3.5 to ±17	V
Operating Temperature SOP8 JEDEC 150mil (EMP8) DFN8-X7 (ESON8-X7)	Ta	 -40 to 85 -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 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, R_L to GND, Ta=25°C, unless otherwise specified

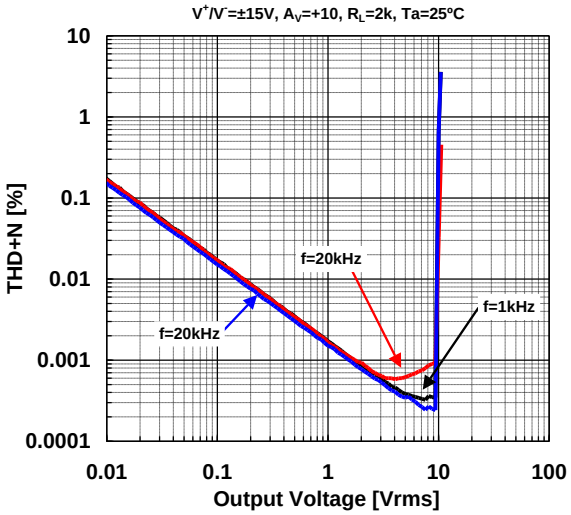
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DC CHARACTERISTICS						
Supply Current	I_{CC}	No Signal, R_L=∞	-	9.0	12.0	mA
Input Offset Voltage	V_{IO}	Rs=50Ω	-	0.8	5.0	mV
Input Bias Current	I_B		-	5	250	pA
Input Offset Current	I_{IO}		-	2	220	pA
Voltage Gain 1	A_{V1}	R_L=10kΩ, V_O=±13V	106	135	-	dB
Voltage Gain 2	A_{V2}	R_L=2kΩ, V_O=±12.8V	105	133	-	dB
Voltage Gain 3	A_{V3}	R_L=600Ω, V_O=±12.5V	105	130	-	dB
Common Mode Rejection Ratio	CMR	V_{ICM}= ±12.5V [*1]	80	110	-	dB
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±3.5 to ±17V	80	110	-	dB
Maximum Output Voltage 1	V_{OM1}	R_L =10kΩ	±13	±14	-	V
Maximum Output Voltage 2	V_{OM2}	R_L =2kΩ	±12.8	±13.8	-	V
Maximum Output Voltage 3	V_{OM3}	R_L =600Ω	±12.5	±13.5	-	V
Common Mode Input Voltage Range	V_{ICM}	CMR≥80dB	±12.5	±14	-	V
AC CHARACTERISTICS						
Gain Bandwidth Product	GBW	f=10kHz	-	11	-	MHz
Unity Gain Frequency	f_T	A_V=+100, R_S=100Ω, R_L=2kΩ, C_L=10pF	-	10	-	MHz
Phase Margin	Φ_M	A_V=+100, R_S=100Ω, R_L=2kΩ, C_L=10pF	-	70	-	Deg
Slew Rate	SR	A_V=1, V_{IN}=2Vp-p, R_L=2kΩ, C_L=10pF	-	25	-	V/μs
Channel Separation	CS	f=1kHz, A_V=+100, R_S=1kΩ, R_L=2kΩ	-	150	-	dB
Total Harmonic Distortion	THD	f=1kHz,AV=+10,Vo=5Vrms,RL=2kΩ	-	0.0004	-	%
Input Noise Voltage1	e_n	f=1kHz	-	8.0	-	nV/√Hz
Input Noise Voltage2	V_{NI}	f=20Hz to 20kHz	-	1.1	-	μVrms

[*1] CMR is calculated by specified change in offset voltage. (VICM=0V to +12.5V, VICM=0V to -12.5V)

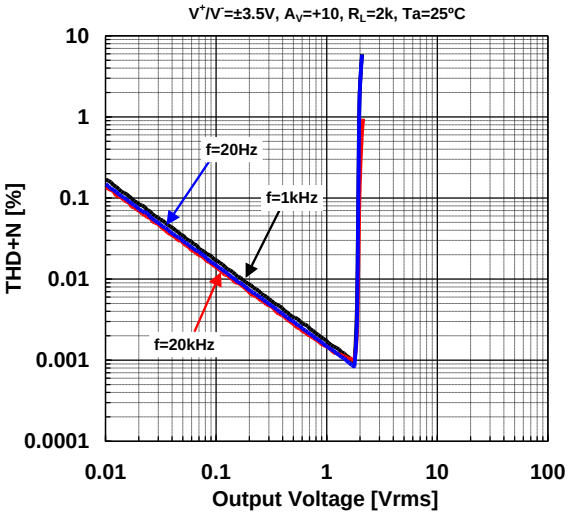
■ TYPICAL CARACTERISTICS

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

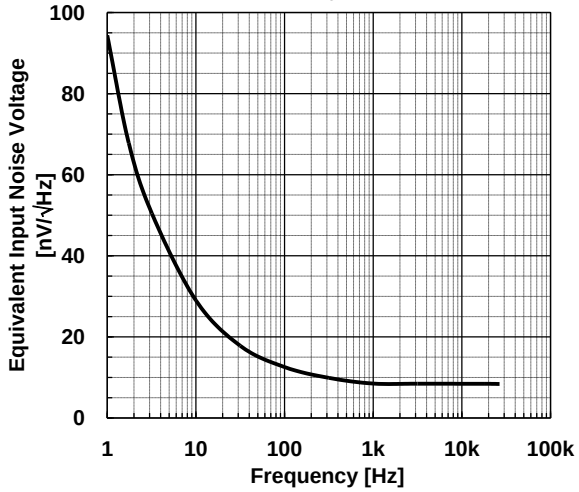
THD+N vs. Output Voltage (Frequency)
V+/V-=±15V, AV=+10, RL=2k, Ta=25°C



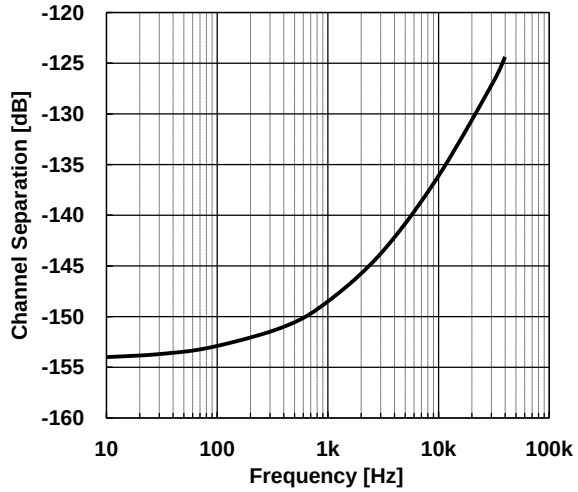
THD+N vs. Output Voltage (Frequency)
V+/V-=±3.5V, AV=+10, RL=2k, Ta=25°C



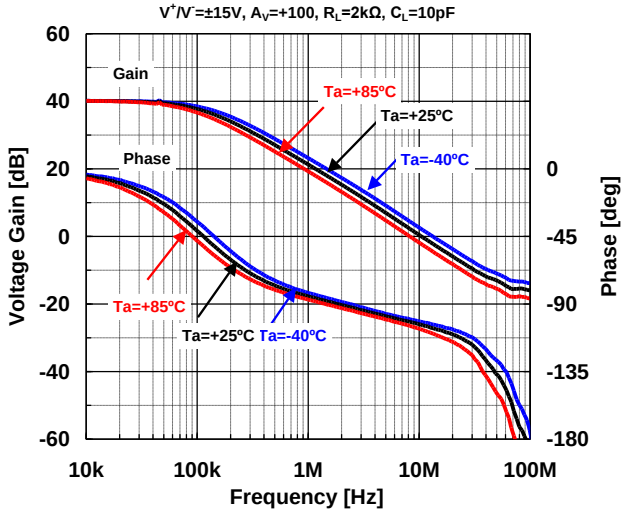
Voltage Noise vs. Frequency
V+/V-=±15V, AV=+100, RS=100Ω, RL=∞, Ta=25°C



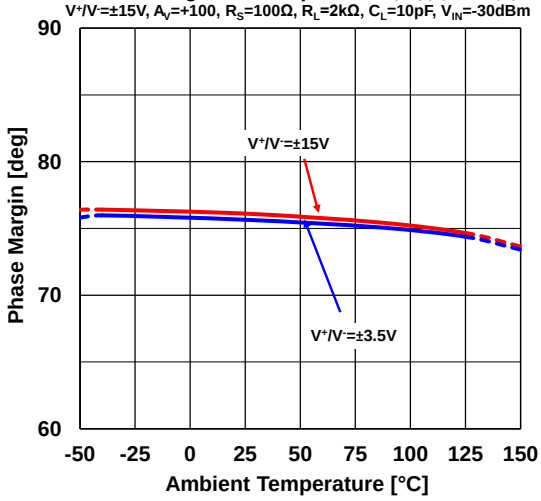
Channel Separation vs. Frequency
V+/V-=±15V, AV=-100, RL=2kΩ, Ta=25°C



Gain vs. Frequency (Temperature)
V+/V-=±15V, AV=+100, RL=2kΩ, CL=10pF



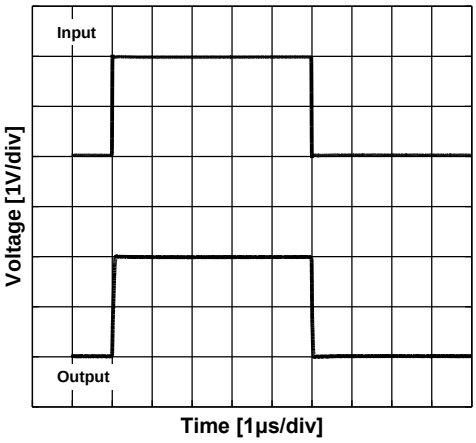
Phase Margin vs. Temperature (Supply Voltage)
V+/V-=±15V, AV=+100, RS=100Ω, RL=2kΩ, CL=10pF, VIN=-30dBm



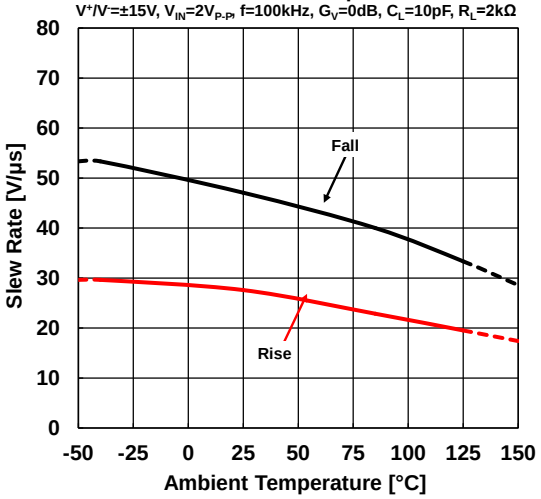
■ TYPICAL CARACTERISTICS

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

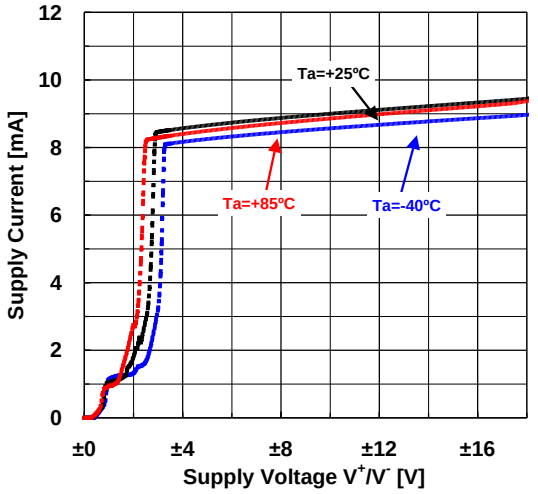
Pulse Response
V^+/V^-=±15V, Gv=0dB, C_L=10pF, R_L=2kΩ, Ta=25°C



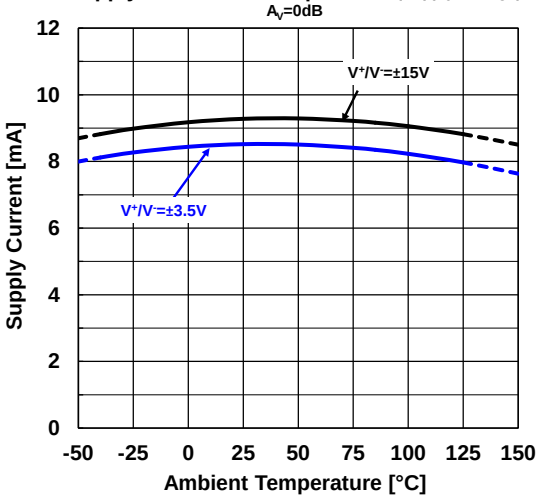
Slew Rate vs. Temperature
V^+/V^-=±15V, V_{IN}=2V_{P-P}, f=100kHz, G_V=0dB, C_L=10pF, R_L=2kΩ



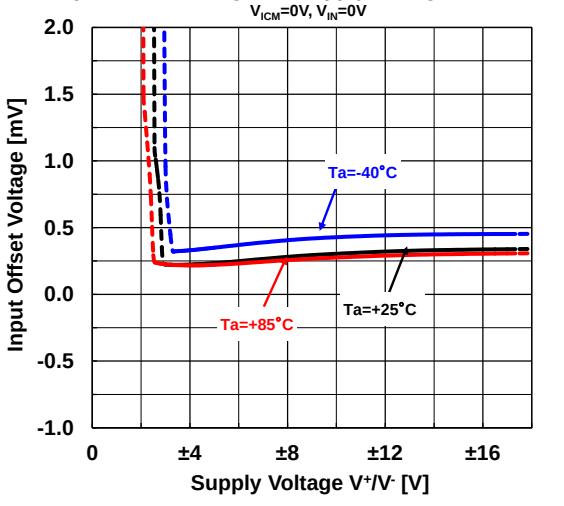
Supply Current vs. Supply Voltage (Temperature)
A_V=0dB



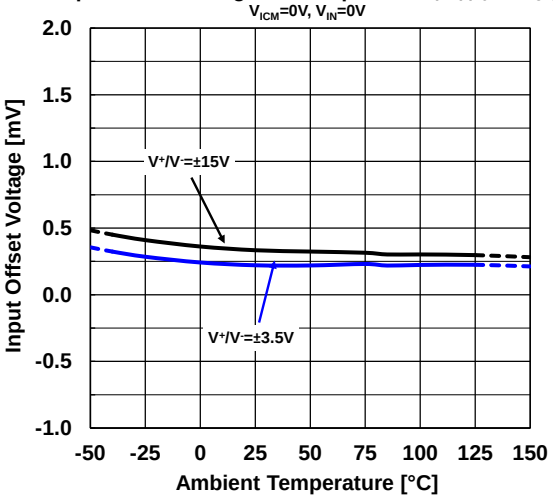
Supply Current vs. Temperature (Supply Voltage)
A_V=0dB



Input Offset Voltage vs. Supply Voltage (Temperature)
V_{ICM}=0V, V_{IN}=0V



Input Offset Voltage vs. Temperature (Supply Voltage)
V_{ICM}=0V, V_{IN}=0V



■ TYPICAL CARACTERISTICS

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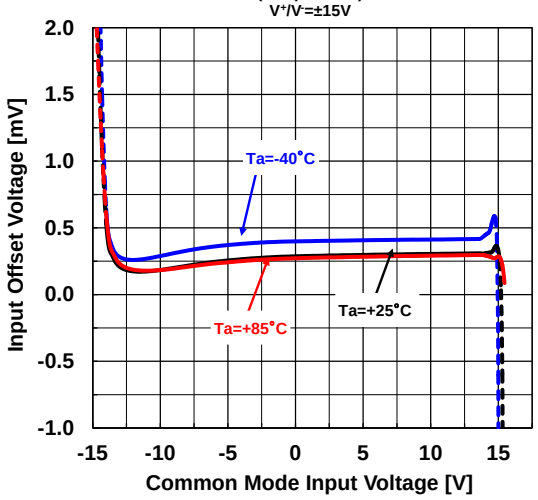
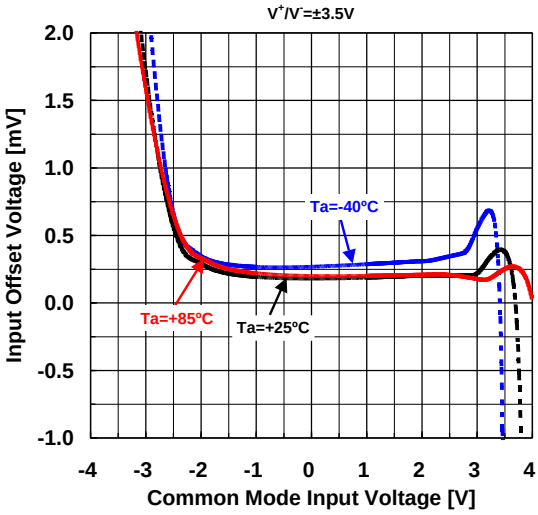
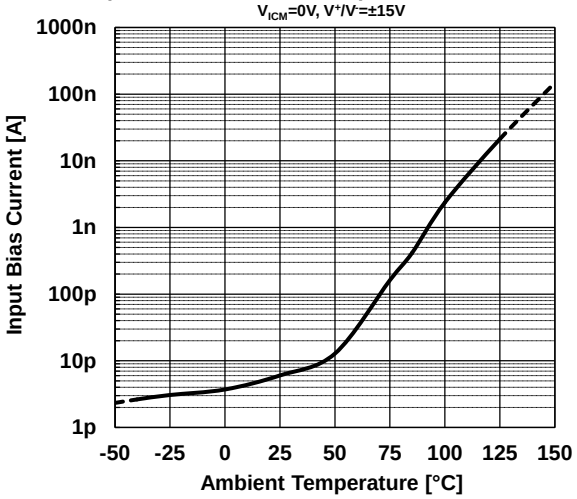
Input Offset Voltage
vs. Common Mode Input Voltage
(Temperature)
V^+/V^-=±15V



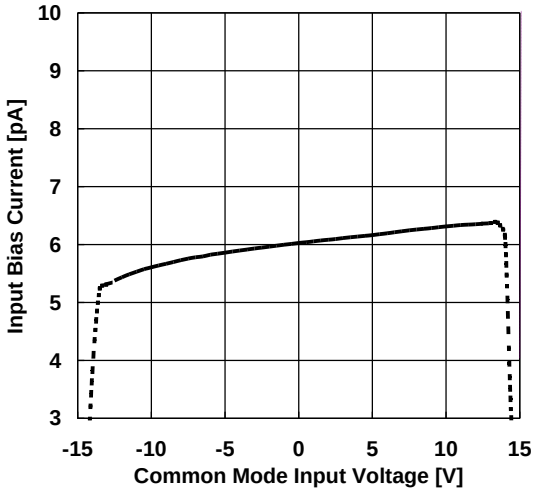
Input Offset Voltage
vs. Common Mode Input Voltage
(Temperature)
V^+/V^-=±3.5V



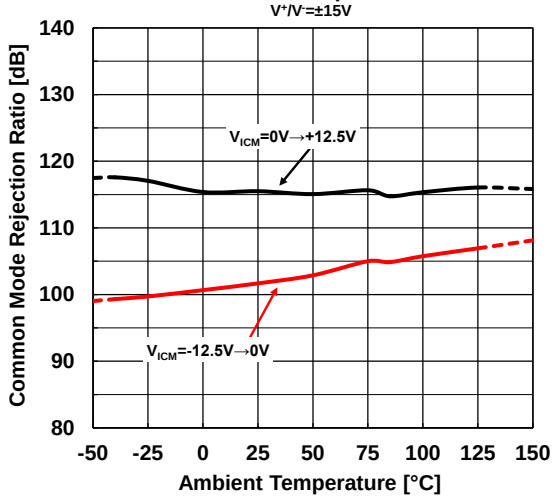
Input Bias Current vs. Temperature (Supply Voltage)
V_{ICM}=0V, V^+/V^-=±15V



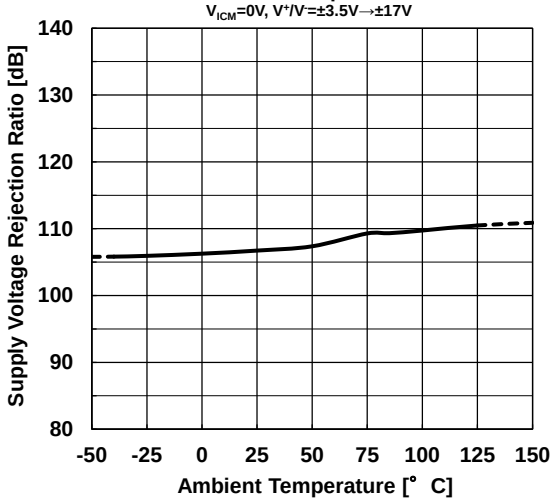
Input Bias Current vs. Common Mode Input Voltage
(Temperature)
V^+/V^-=±15V, Ta=25°C



CMR vs. Temperature
V^+/V^-=±15V



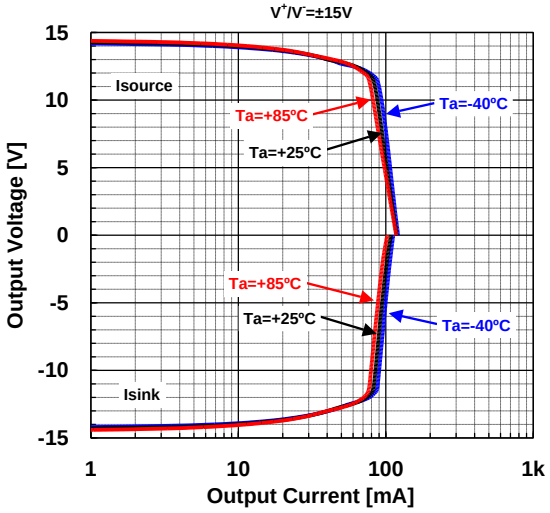
SVR vs. Temperature
V_{ICM}=0V, V^+/V^-=±3.5V→±17V



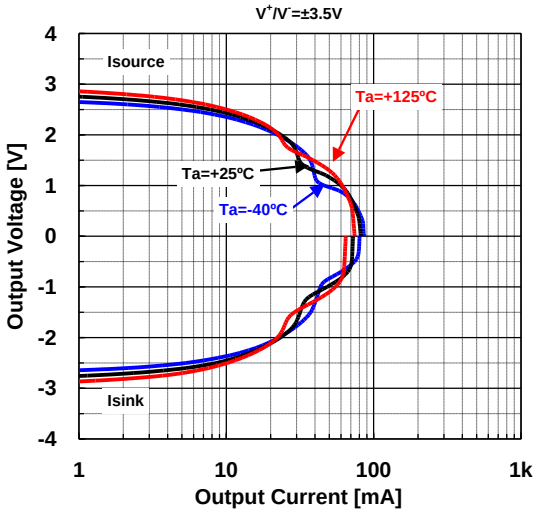
■ TYPICAL CARACTERISTICS

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

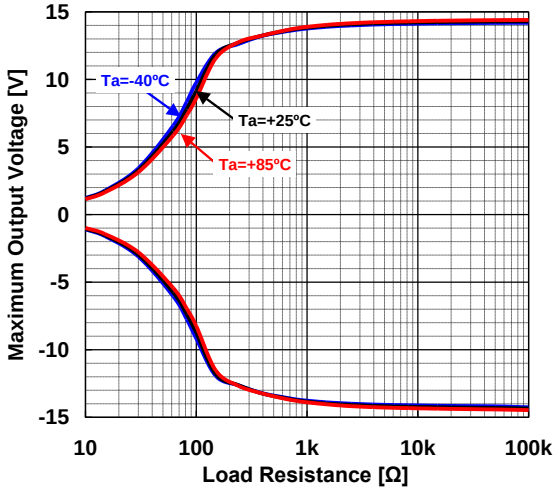
Output Voltage vs. Output Current (Temperature)
V^+/V^-=±15V



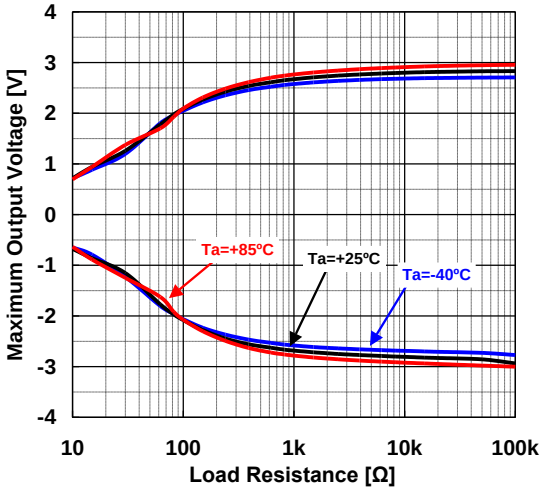
Output Voltage vs. Output Current (Temperature)
V^+/V^-=±3.5V



Maximum Output Voltage vs. Load Resistance
(Temperature)
V^+/V^-=±15V, Gv=open, R_L to 0V



Maximum Output Voltage vs. Load Resistance
(Temperature)
V^+/V^-=±3.5V, Gv=open, R_L to 0V



■ TEST CIRCUITS

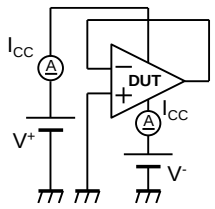


Figure 1. Supply Current

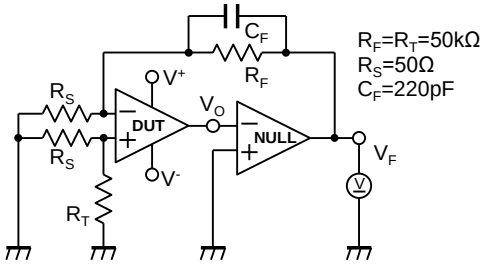


Figure 2. Input Offset Voltage

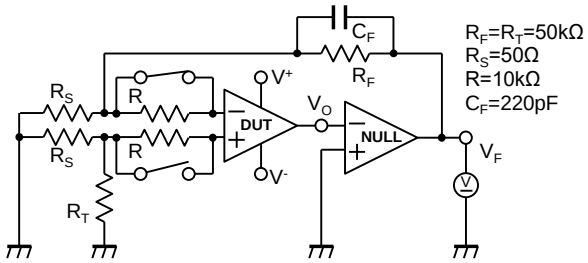


Figure 3. Input Bias Current

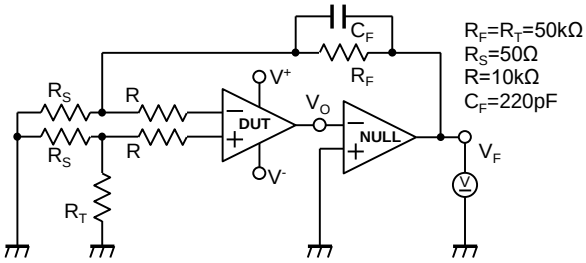


Figure 4. Input Offset Current

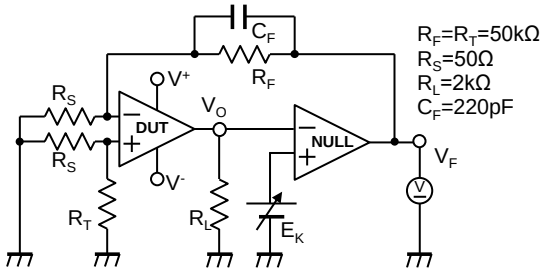


Figure 5. Open-Loop Voltage Gain

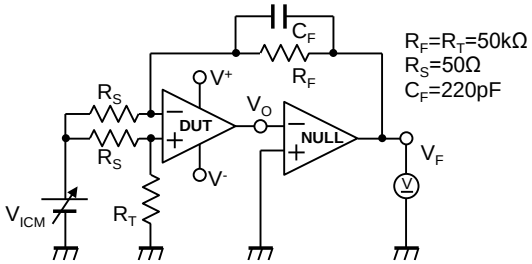


Figure 6. Common Mode Rejection Ratio

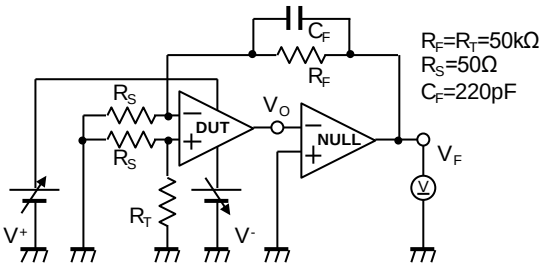


Figure 7. Supply Voltage Rejection Ratio

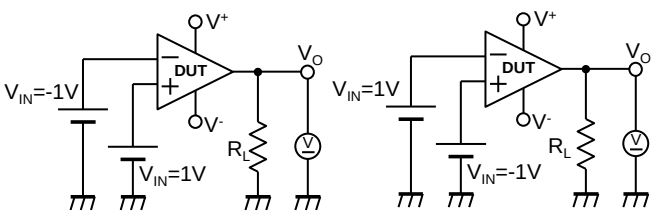


Figure 8. Maximum Output Voltage

■ TEST CIRCUITS

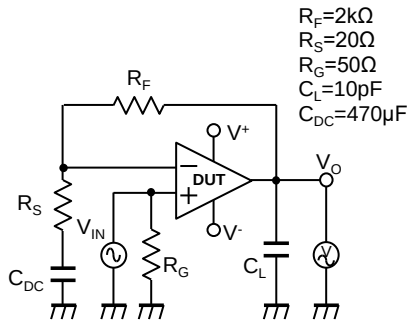


Figure 9. Gain Bandwidth Product

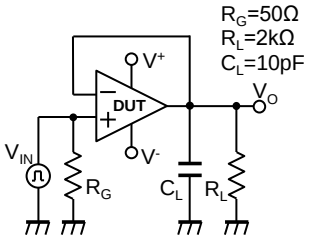


Figure 10. Slew Rate

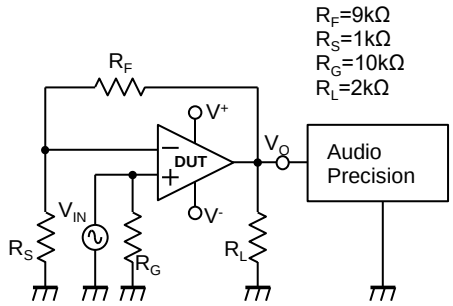


Figure 11. Total Harmonic Distor

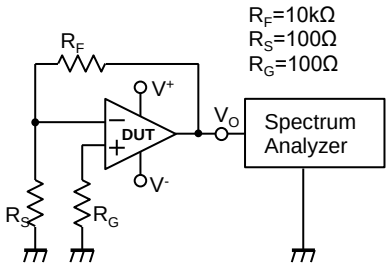
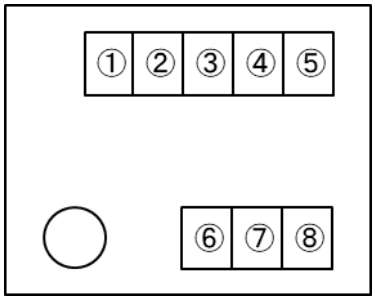


Figure 12. Input Noise Voltage

■ MARKING SPECIFICATION (SOP8 JEDEC 150mil (EMP8))

①②③④⑤: Product Cord Refer to Part Marking List
⑥⑦⑧: Control Number



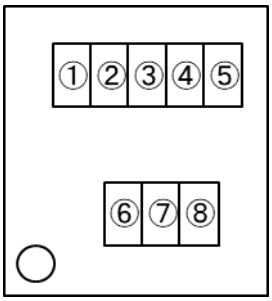
SOP8 JEDEC 150mil (EMP8) Part Markings

Part Marking List (SOP8 JEDEC 150mil (EMP8))

Product Name	①	②	③	④	⑤
MUSES8920AE	8	9	2	0	A

■ MARKING SPECIFICATION (DFN8-X7 (ESON8-X7))

①②③④⑤: Product Cord Refer to Part Marking List
⑥⑦⑧: Control Number



DFN8-X7 (ESON8-X7) Part Markings

Part Marking List (DFN8-X7 (ESON8-X7))

Product Name	①	②	③	④	⑤
MUSES8920AKX7	8	9	2	0	A

NOTICE
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI.

■ NOTE

Precaution for counterfeit semiconductor products

We have recently detected many counterfeit semiconductor products that have very similar appearances to our operational amplifier “MUSES” in the world-wide market.In most cases, it is hard to distinguish them from our regular products by their appearance, and some of them have very poor quality and performance.
They can not provide equivalent quality of our regular product, and they may cause breakdowns or malfunctions if used in your systems or applications.

We would like our customers to purchase “MUSES” through our official sales channels : our sales branches, sales subsidiaries and distributors.

Please note that we hold no responsibilities for any malfunctions or damages caused by using counterfeit products. We would appreciate your understanding.

■ REVISION HISTORY

Date	Revision	Contents of Changes
March 1, 2024	Ver. 1.0	Initial release

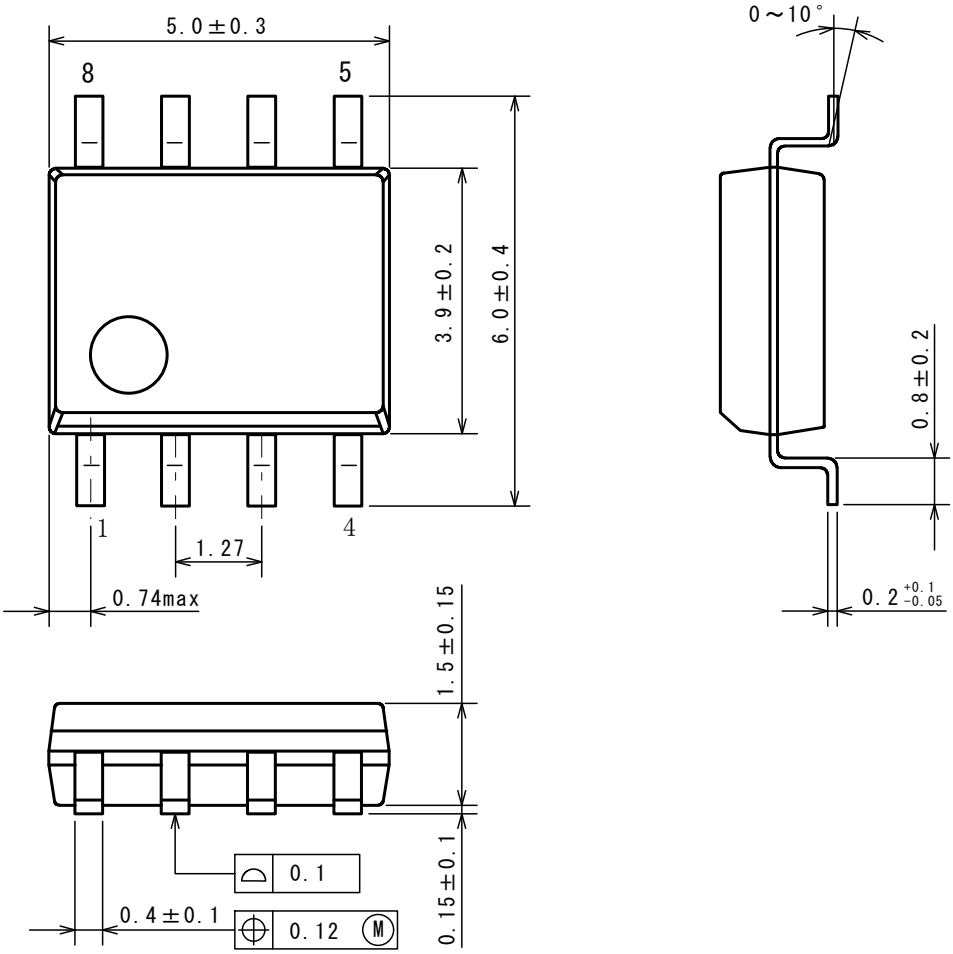
Nisshinbo Micro Devices Inc.

SOP8 JEDEC 150mil(EMP8)

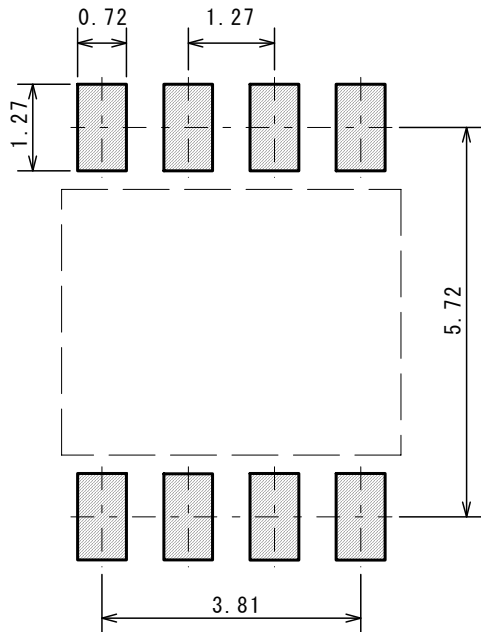
PI-SOP8 JEDEC 150mil-E-B

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



Nisshinbo Micro Devices Inc.

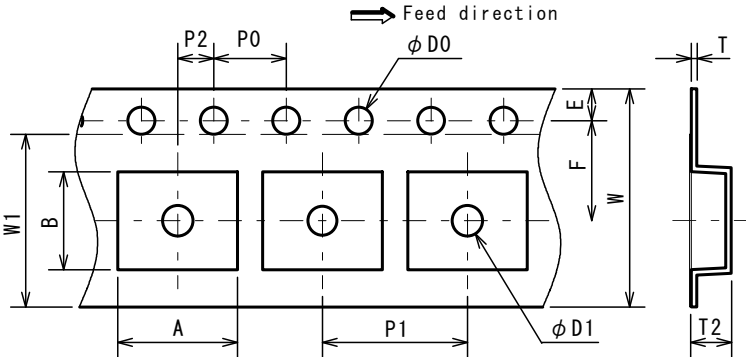
SOP8 JEDEC 150mil(EMP8)

PI-SOP8 JEDEC 150mil-E-B

■ PACKING SPEC

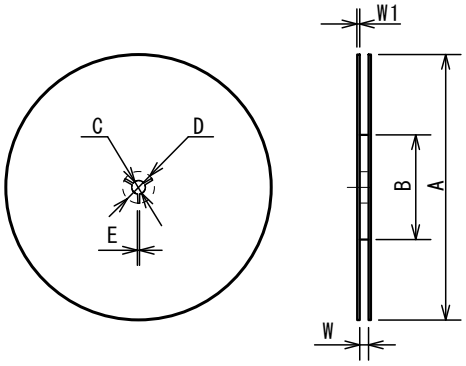
UNIT: mm

TAPING DIMENSIONS



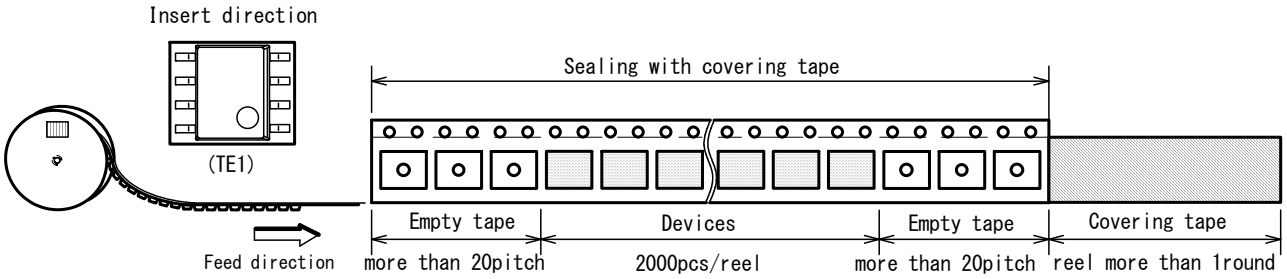
SYMBOL	DIMENSION	REMARKS
A	6.6	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{0}$	
D1	1.7±0.1	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	2.2	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

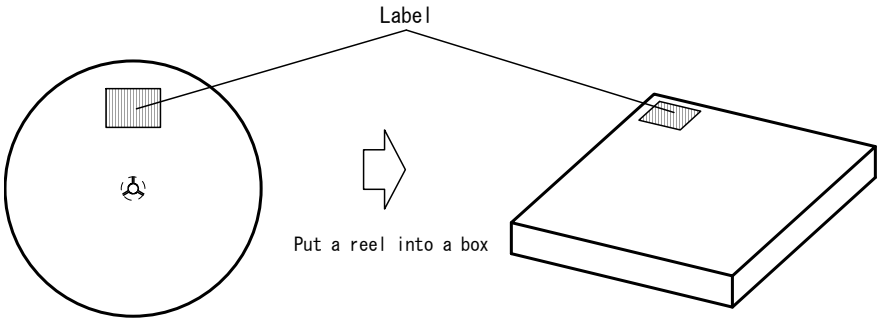


SYMBOL	DIMENSION
A	φ330±2
B	φ 80±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13.5±0.5
W1	2.0±0.2

TAPING STATE



PACKING STATE



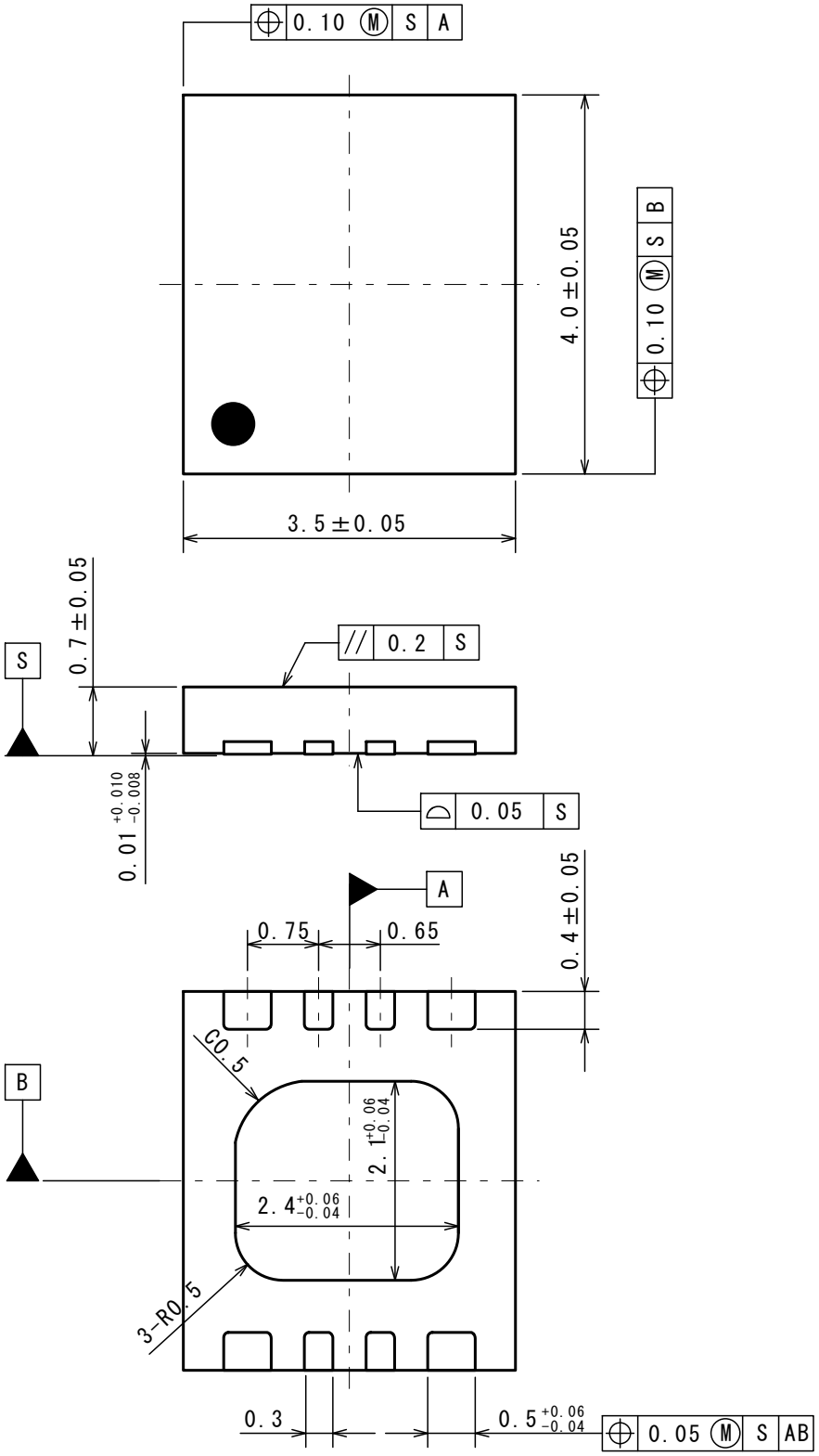
Nisshinbo Micro Devices Inc.

DFN8-X7(ESON8-X7)

PI-DFN8-X7-E-B

■ PACKAGE DIMENSIONS

UNIT: mm



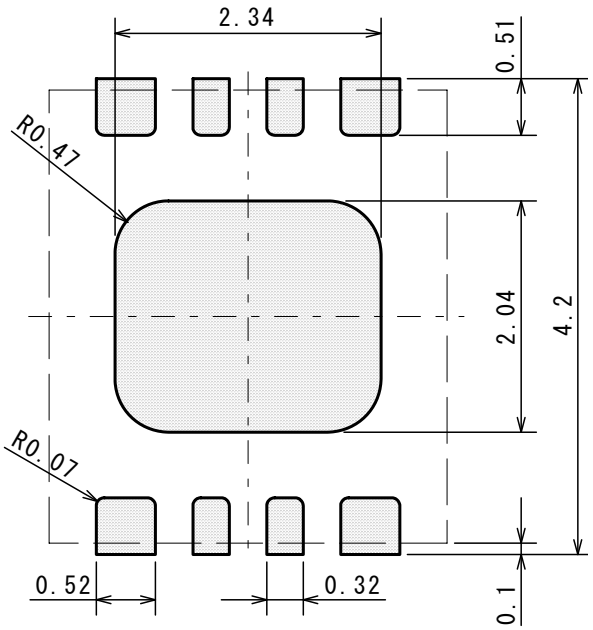
Nisshinbo Micro Devices Inc.

DFN8-X7(ESON8-X7)

PI-DFN8-X7-E-B

■ EXAMPLE OF SOLDER PADS DIMENSIONS

UNIT: mm



Nisshinbo Micro Devices Inc.

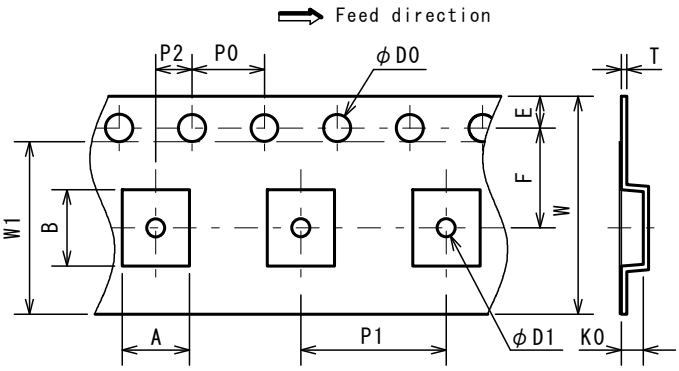
DFN8-X7(ESON8-X7)

PI-DFN8-X7-E-B

■ PACKING SPEC

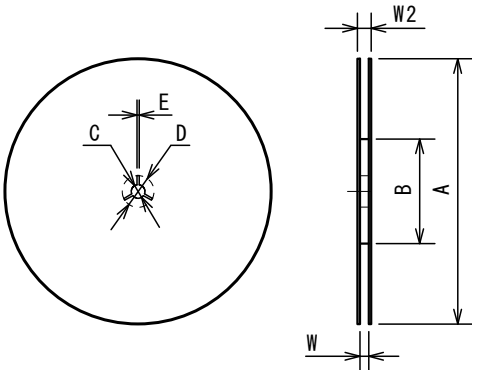
UNIT: mm

TAPING DIMENSIONS



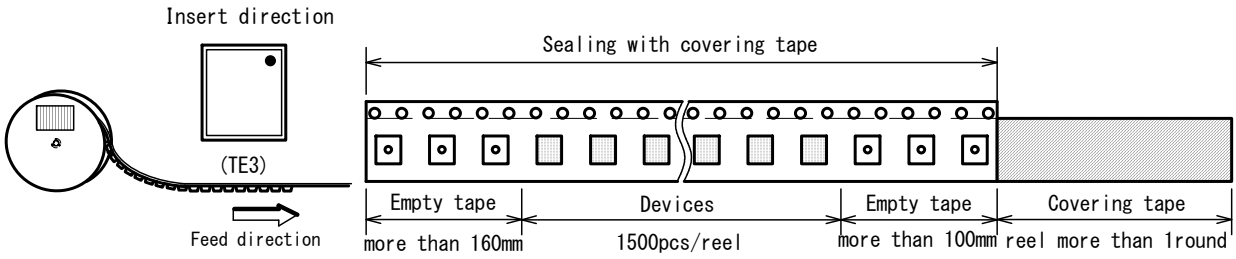
SYMBOL	DIMENSION	REMARKS
A	3.7±0.05	BOTTOM DIMENSION
B	4.2±0.05	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{0}$	
D1	1.0±0.1	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.25±0.05	
K0	0.85±0.05	
W	$12.0^{+0.3}_{-0.1}$	
W	9.5	THICKNESS 0.1max

REEL DIMENSIONS



SYMBOL	DIMENSION
A	$\phi 180^{0}_{-3}$
B	$\phi\ 60^{+1}_{0}$
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13^{+1}_{0}
W2	15.4±1.0

TAPING STATE



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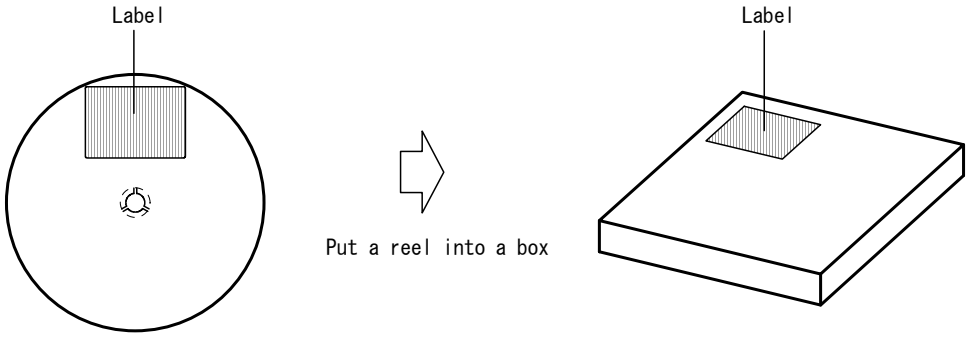

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