MUSES8921

High Quality Sound, J-FET Input Dual Operational Amplifier

FEATURES

- High Quality Sound
- Low Noise 8.0nV/√Hz
- Low Distortion 0.0004%
- 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 EMP-8-AN, DFN4035-8-GR

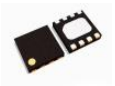
DESCRIPTION

The MUSES8921 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 MUSES8921 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

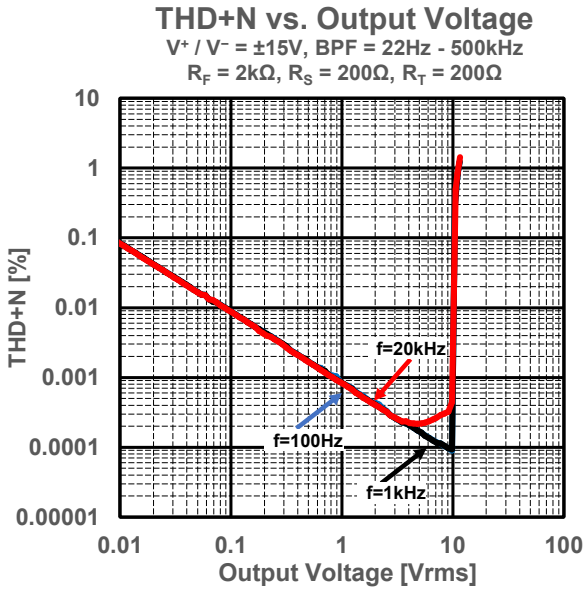
- Home Audio
- Professional Audio
- Car Audio
- Portable Audio

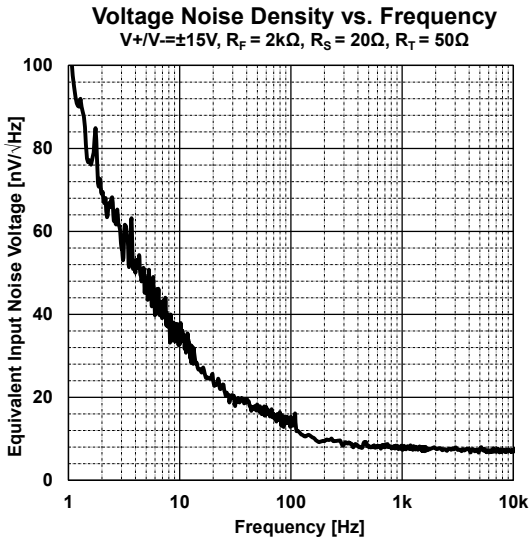
MUSES8921AN
(EMP-8-AN)



MUSES8921GR
(DFN4035-8-GR)

THD+N and Voltage Noise Density





■ PRODUCT NAME INFORMATION

MUSES8921 aa A bb S

Description of configuration

Suffix	Item	Description
aa	Package code	Indicates the package. Refer to the order information. AN: EMP-8-AN GR: DFN4035-8-GR
A	Version	Indicates the product version. “A” is initial version.
bb	Packing	Refer to the packing specifications.
S	Grade	Indicates the quality grade. S: Standard

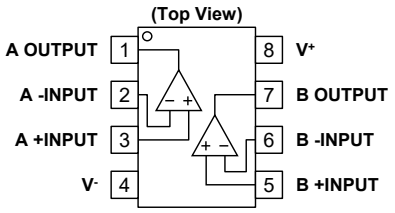
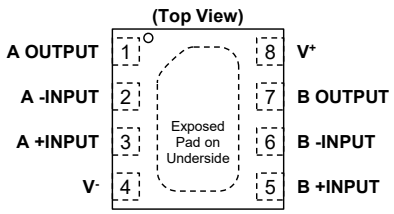
Grade

	Applications	Operating Temperature Range	Test Temperature
S	General−purpose and Consumer application	-40°C to 125°C	25°C

■ ORDER INFORMATION

Product Name	Package	RoHS	Halogen-Free	Terminal Finish	Weight (mg)	Quantity (pcs/reel)
MUSES8921ANAE2S	EMP-8-AN	✓	✓	Sn2Bi	76	2000
MUSES8921GRAE4S	DFN4035-8-GR	✓	✓	Sn2Bi	18	1500

■ PIN DESCRIPTIONS

Product Name	MUSES8921AN	MUSES8921GR
Package	EMP-8-AN	DFN4035-8-GR
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
Storage Temperature	T_{stg}	-50 to 150	°C
Junction Temperature *3	T_j	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 Calculate the power consumption of the IC from the operating conditions, and calculate the junction temperature with the thermal resistance. Please refer to "Thermal characteristics" for the thermal resistance under our measurement board conditions.

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)	
EMP-8-AN	157 *1 / 103 *2	16 *1 / 12 *2	°C/W
DFN4035-8-GR	182 *3 / 44 *4	-	

Θja :Junction-to-Ambient Thermal Resistance
ψjt:Junction-to-Top Thermal Characterization Parameter
*1 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).
*2 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).
*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.)

■ ELECTROSTATIC DISCHARGE (ESD) PROTECTION VOLTAGE

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

ELECTROSTATIC DISCHARGE RATINGS

The electrostatic discharge tests are done based on JEDEC JS-001 and JS-002.
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	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 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

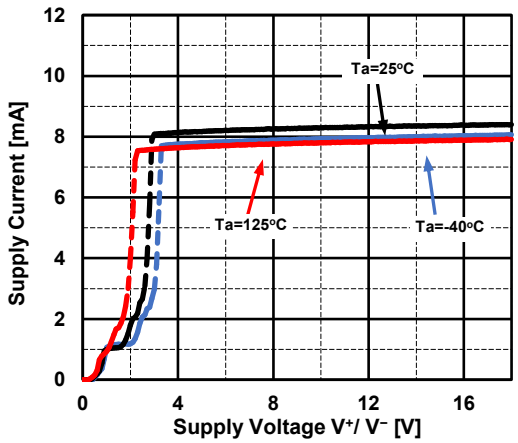
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DC CHARACTERISTICS						
Supply Current	I_{CC}	No Signal, R_L=∞	-	9.0	12.0	mA
Input Offset Voltage	V_{IO}	Rs=50Ω	-	0.8	5.0	mV
Input Bias Current	I_B		-	5	250	pA
Input Offset Current	I_{IO}		-	2	220	pA
Voltage Gain 1	A_{V1}	R_L=10kΩ, V_O=±13V	105	125	-	dB
Voltage Gain 2	A_{V2}	R_L=2kΩ, V_O=±12.8V	105	125	-	dB
Voltage Gain 3	A_{V3}	R_L=600Ω, V_O=±12.5V	105	125	-	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)

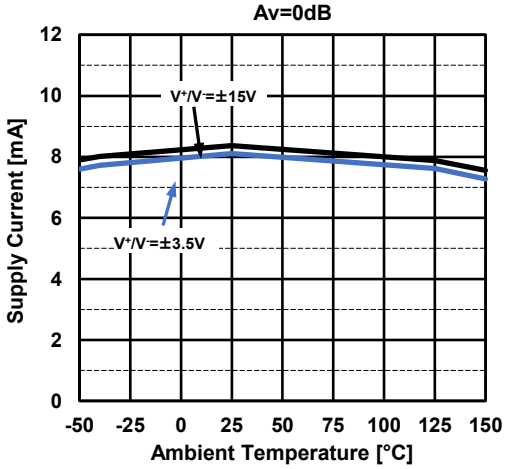
■ TYPICAL CHARACTERISTICS

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

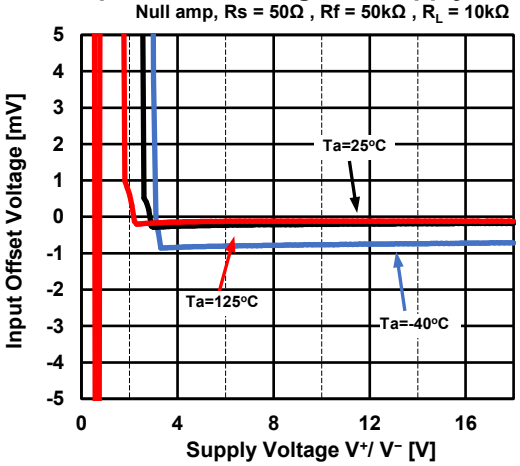
Supply Current vs. Supply Voltage
Av=0dB



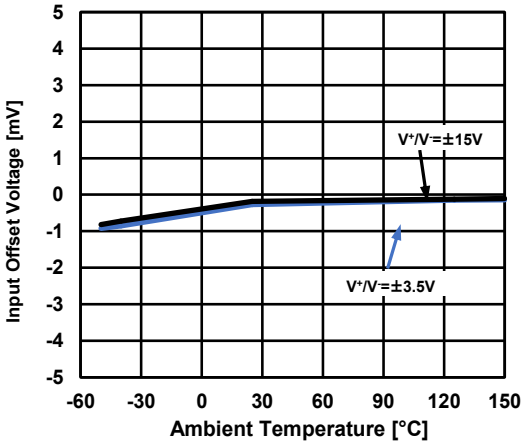
Supply Current vs. Temperature
Av=0dB



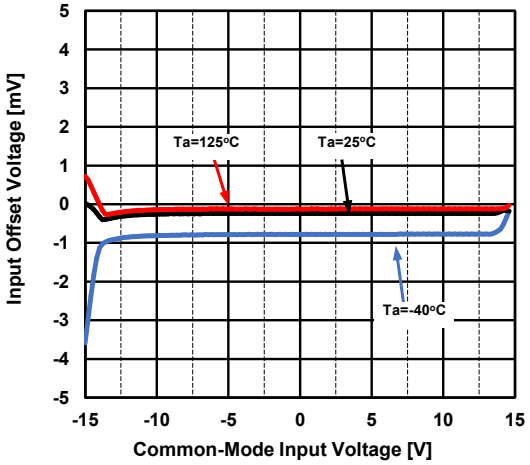
Input Offset Voltage vs. Supply Voltage
Null amp, Rs = 50Ω , Rf = 50kΩ , R_L = 10kΩ



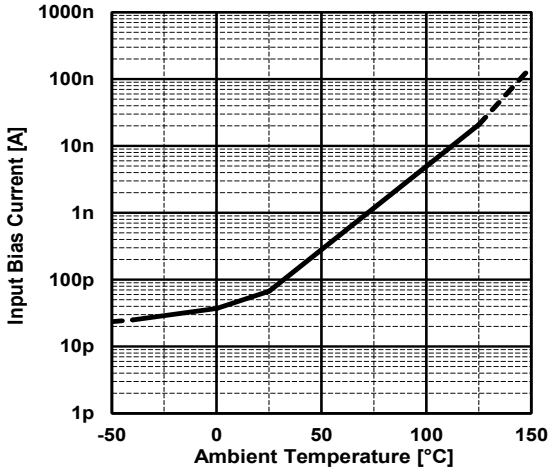
Input Offset Voltage vs. Temperature
Null amp, Rs = 50Ω , Rf = 50kΩ , R_L = 10kΩ



Input Offset Voltage vs. Common-Mode Input Voltage
V+/V-=±15V, Rs = 50Ω , Rf = 50kΩ , R_L = 10kΩ , C_L = 10pF



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

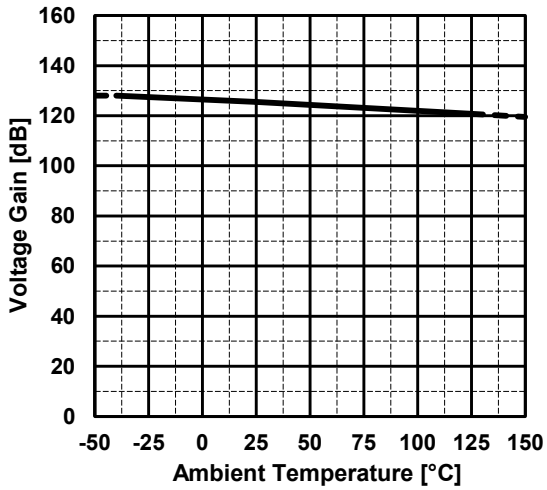


■ TYPICAL CHARACTERISTICS

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

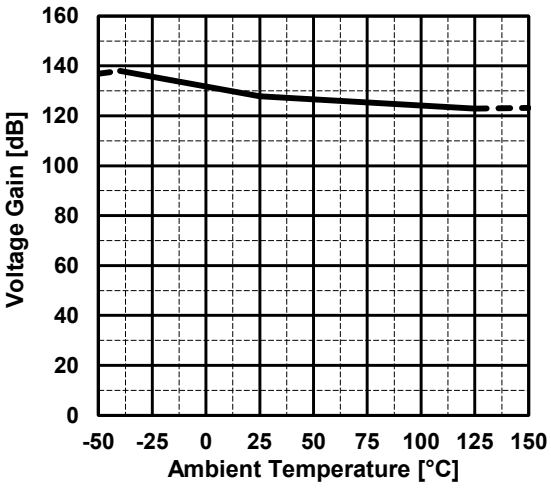
Voltage Gain vs. Temperature

V^+/V^-=±15V , R_L = 10kΩ, Vo = ±13V



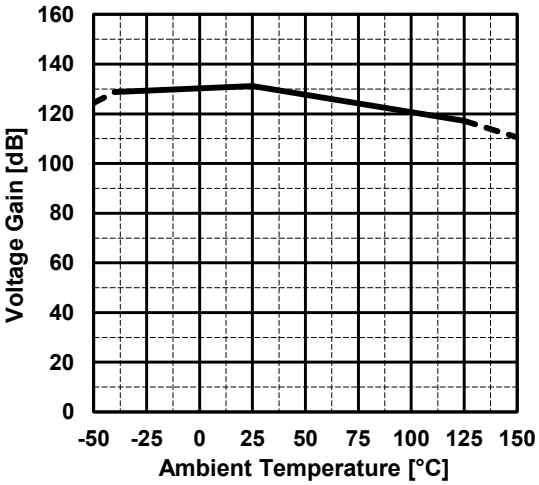
Voltage Gain vs. Temperature

V^+/V^-=±15V , R_L = 2kΩ, Vo = ±12.8V



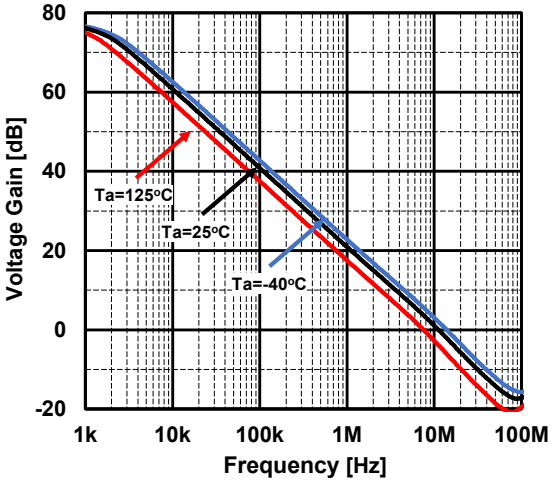
Voltage Gain vs. Temperature

V^+/V^-=±15V , R_L = 600Ω, Vo = ±12.5V



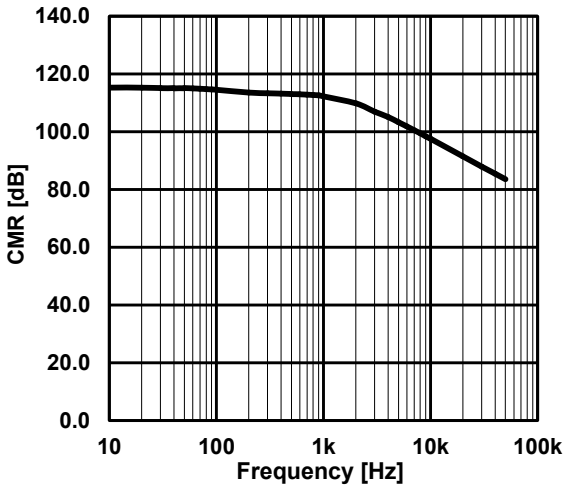
Voltage Gain vs. Frequency

V^+/V^-= ±15V, A_V=80dB, R_F=100k, Rs=10, R_L= 2kΩ , C_L= 10pF



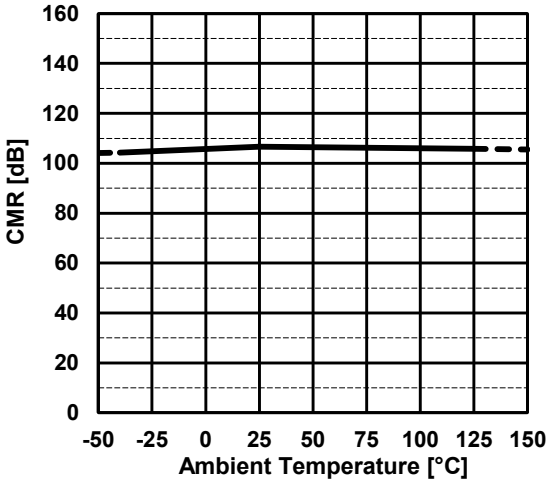
CMR vs Frequency

V+/V-=±15V, Av = 40dB , Rs = 1kΩ , RL = 2kΩ



CMR vs. Temperature

V+/V-=±15V, Rs = 50Ω , Rf = 50kΩ , R_L = 10kΩ , C_L = 10pF



■ TYPICAL CHARACTERISTICS

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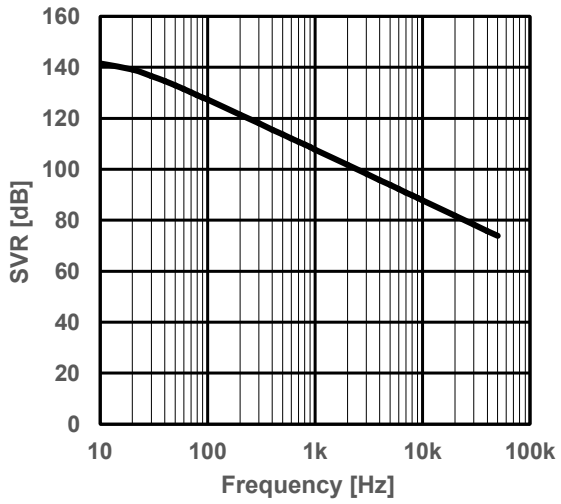
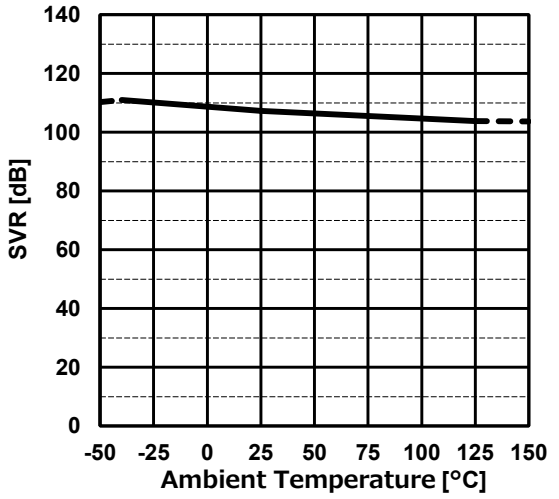
SVR vs Frequency

V⁺/V⁻=±15V, Av = 40dB , Rs = 1kΩ , R_L = 2kΩ



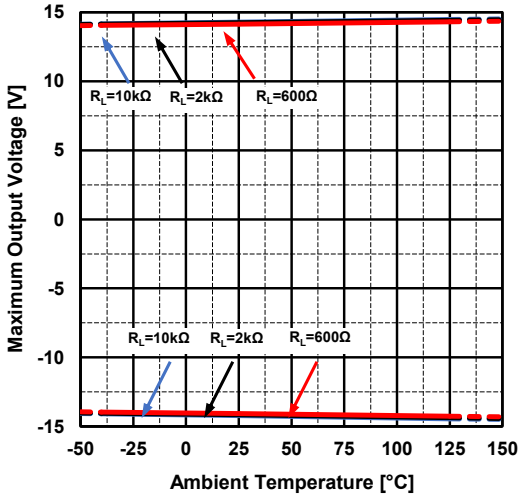
SVR vs. Temperature

Null amp, V⁺/V⁻=±3.5 to ±17V, Rs = 50Ω , Rf = 50kΩ , R_L = 10kΩ



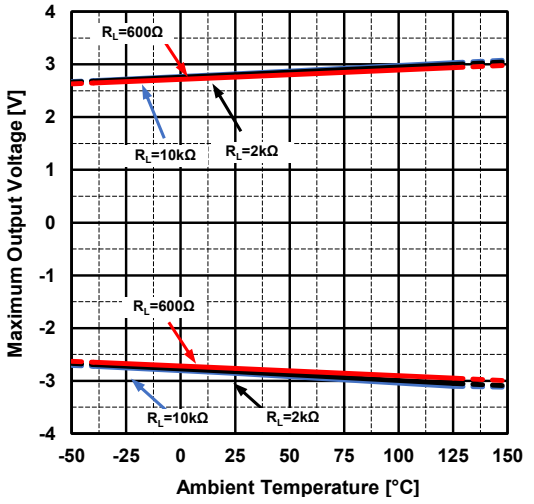
Maximum Output Voltage vs. Temperature

V⁺/V⁻=±15V



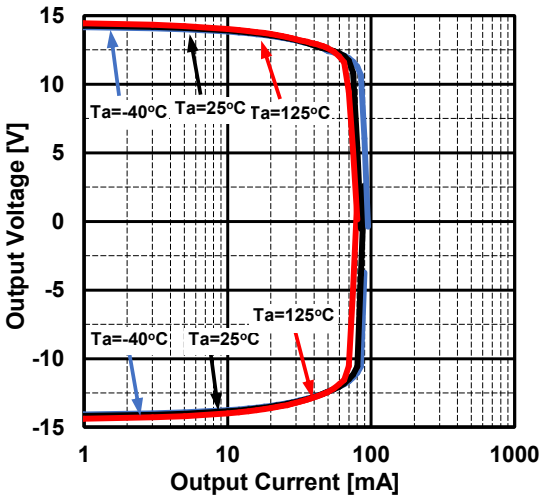
Maximum Output Voltage vs. Temperature

V⁺/V⁻=±3.5V



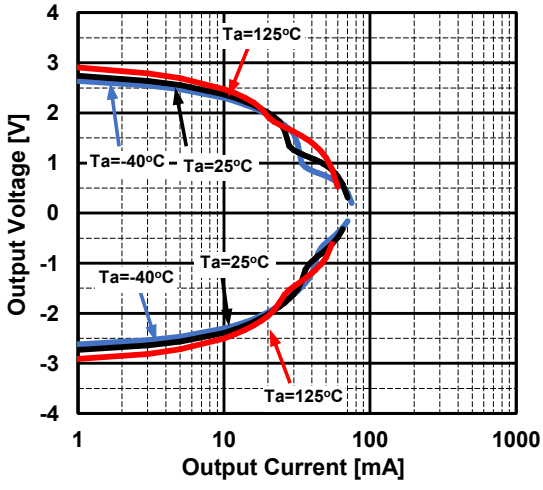
Output Voltage vs. Output Current

V⁺ / V⁻ = ±15V



Output Voltage vs. Output Current

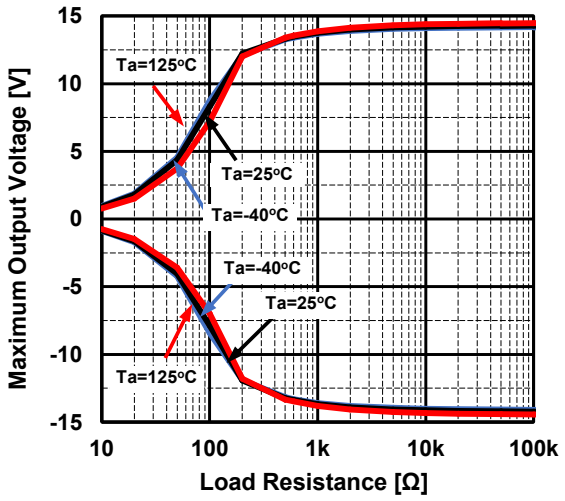
V⁺ / V⁻ = ±3.5V



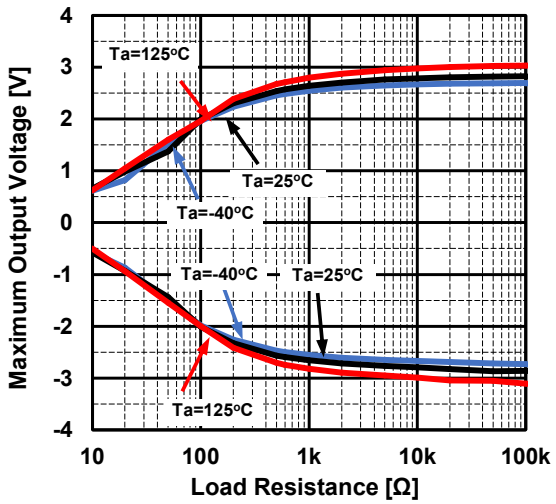
■ TYPICAL CHARACTERISTICS

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

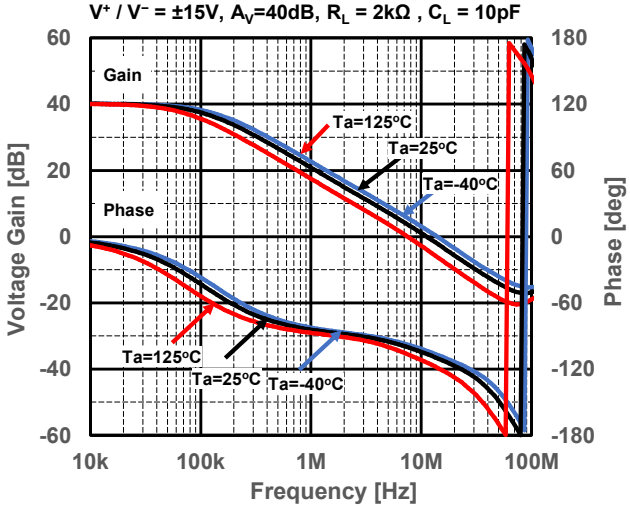
Maximum Output Voltage vs. Load Resistance
V⁺/V⁻=±15V



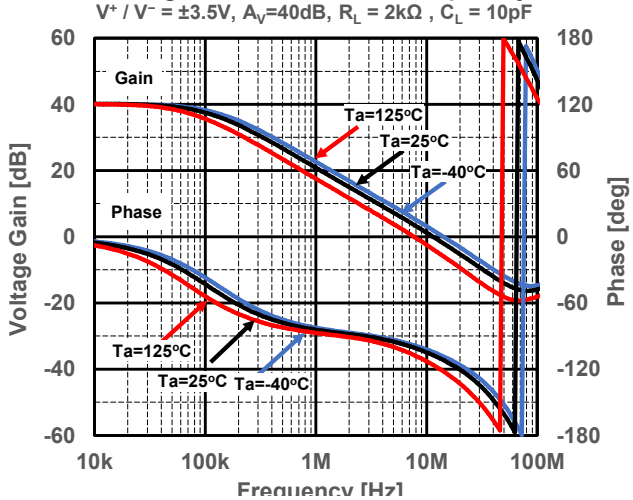
Maximum Output Voltage vs. Load Resistance
V⁺/V⁻=±3.5V



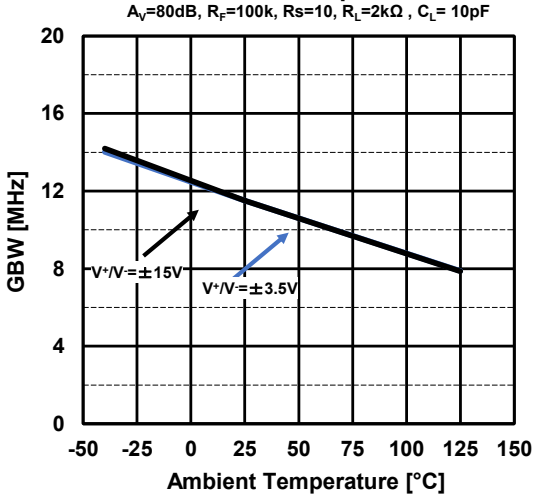
Voltage Gain/ Phase vs. Frequency
V⁺ / V⁻ = ±15V, A_V=40dB, R_L = 2kΩ , C_L = 10pF



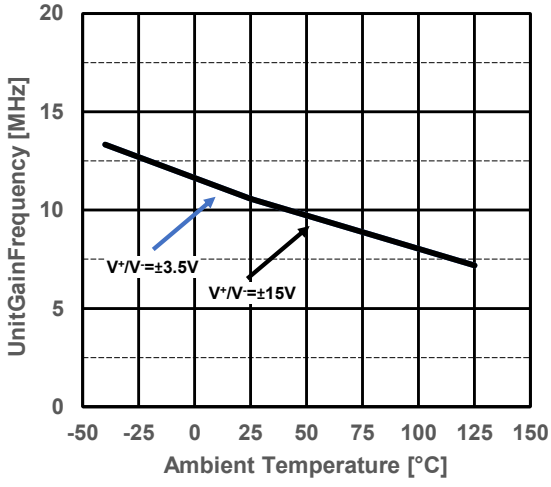
Voltage Gain/ Phase vs. Frequency
V⁺ / V⁻ = ±3.5V, A_V=40dB, R_L = 2kΩ , C_L = 10pF



GBW vs. Temperature
A_V=80dB, R_F=100k, Rs=10, R_L=2kΩ , C_L= 10pF



UnitGainFrequency vs. Temperature
V_{in}=-40dBm, A_V=40dB, R_L = 2kΩ , C_L = 10pF

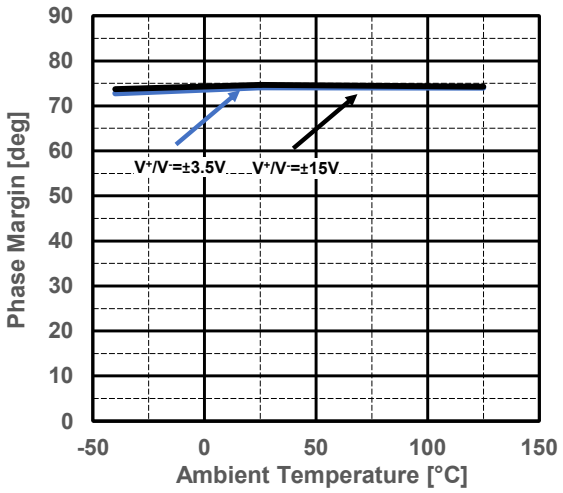


■ TYPICAL CHARACTERISTICS

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

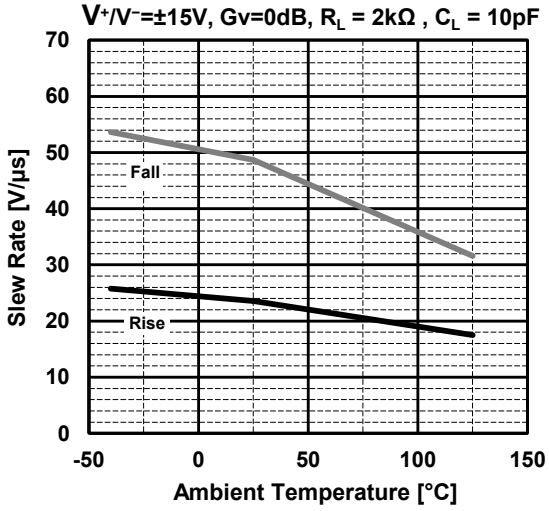
Phase Margin vs. Temperature

V_{in}=-40dBm, A_V=40dB, R_L = 2kΩ , C_L = 10pF



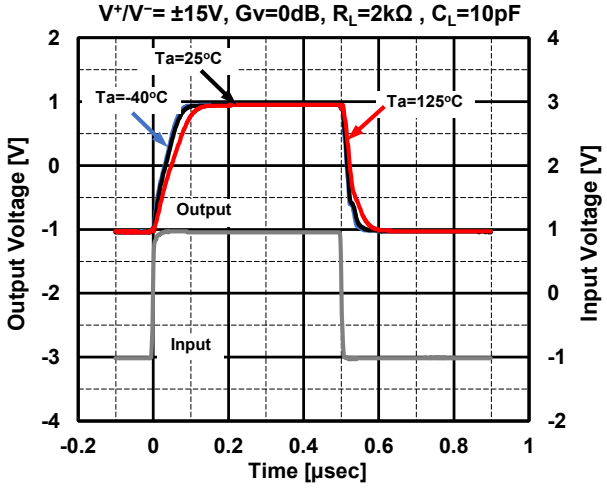
Slew Rate vs. Temperature

V+/V-=±15V, Gv=0dB, R_L = 2kΩ , C_L = 10pF



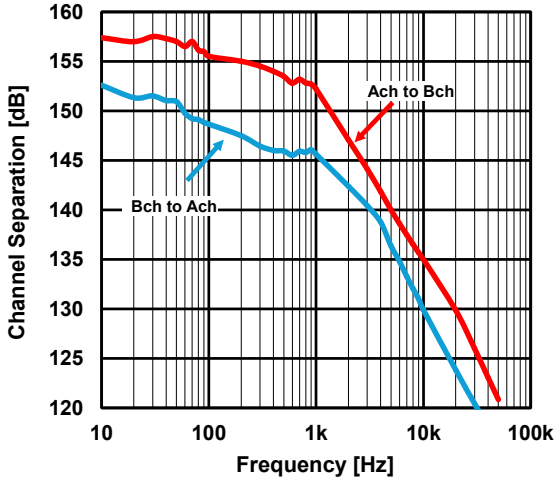
Pulse Response

V+/V-= ±15V, Gv=0dB, R_L=2kΩ , C_L=10pF



Channel Separation vs. Frequency

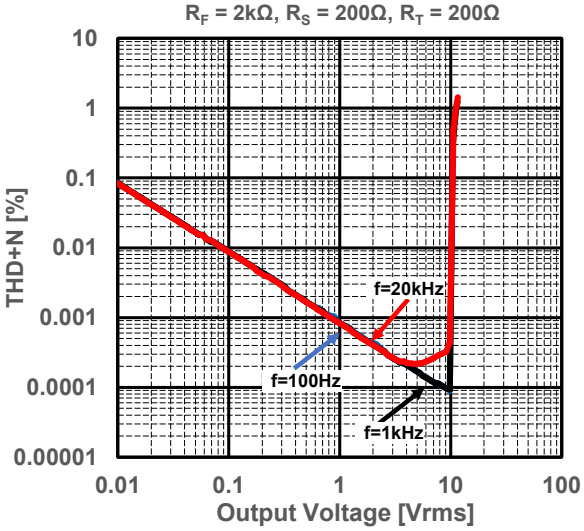
V+/V-=±15V, Av = 40dB , Rs = 1kΩ , R_L = 2kΩ



THD+N vs. Output Voltage

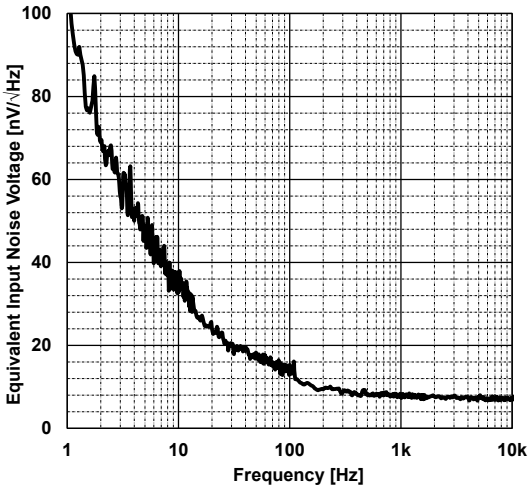
V+ / V- = ±15V, BPF = 22Hz - 500kHz

R_F = 2kΩ, R_S = 200Ω, R_T = 200Ω



Voltage Noise Density vs. Frequency

V+/V-=±15V, R_F = 2kΩ, R_S = 20Ω, R_T = 50Ω



■ TEST CIRCUITS

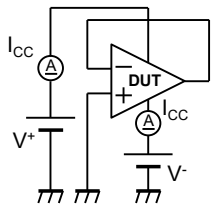


Figure 1. Supply Current

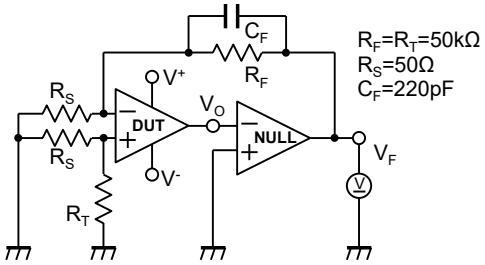


Figure 2. Input Offset Voltage

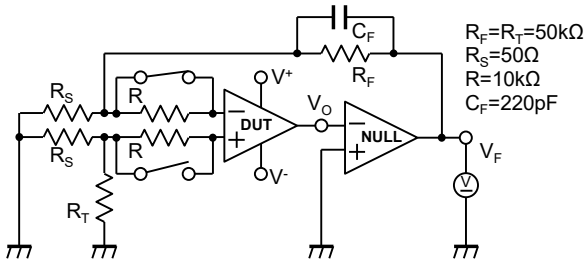


Figure 3. Input Bias Current

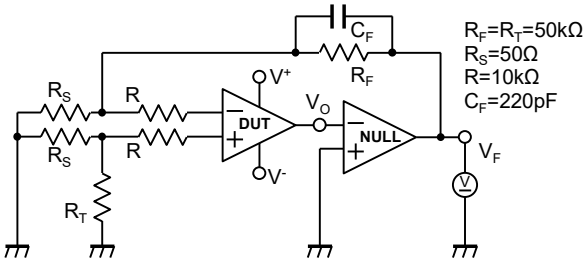


Figure 4. Input Offset Current

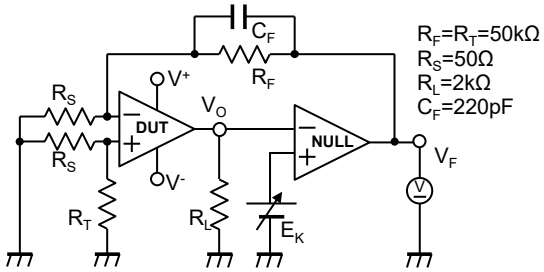


Figure 5. Open-Loop Voltage Gain

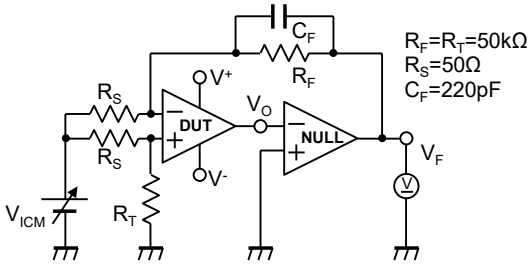


Figure 6. Common Mode Rejection Ratio

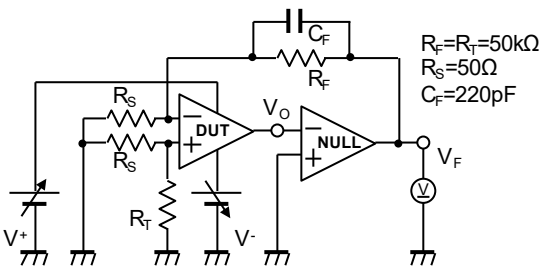


Figure 7. Supply Voltage Rejection Ratio

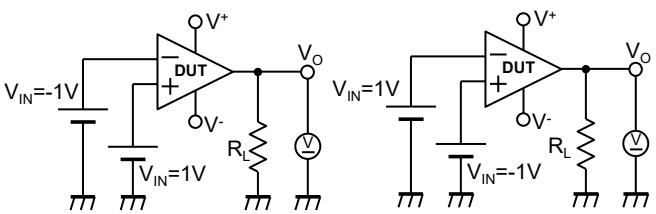


Figure 8. Maximum Output Voltage

■ TEST CIRCUITS

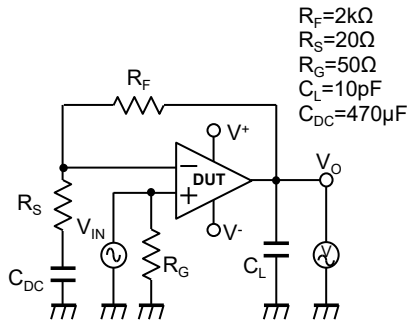


Figure 9. Gain Bandwidth Product

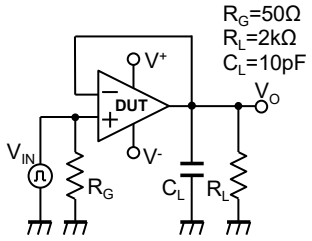
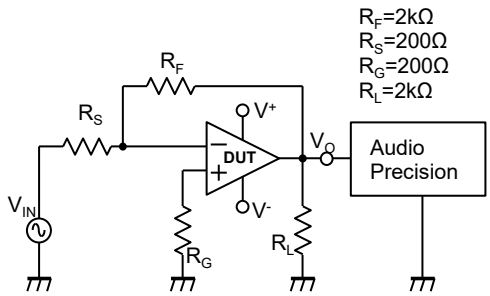


Figure 10. Slew Rate



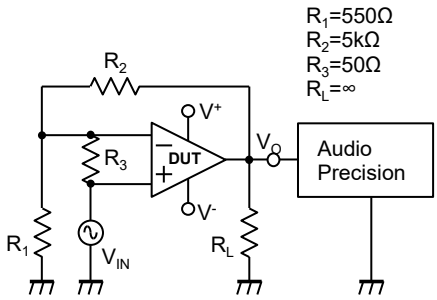
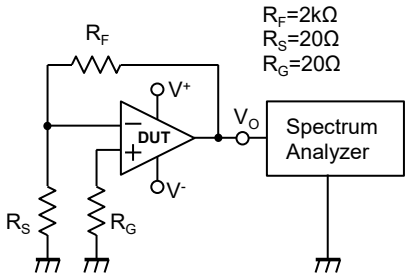


Figure 11. Total Harmonic Distor



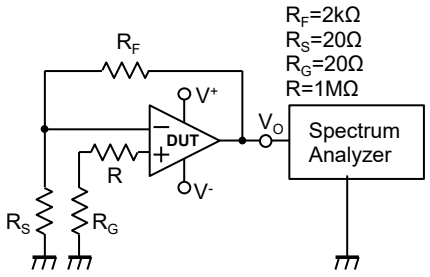
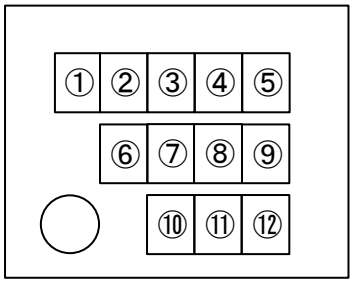


Figure 12. Input Noise Voltage

■MARKING SPECIFICATION (EMP-8-AN)

①②③④⑤⑥⑦⑧⑨: Product Cord Refer to Part Marking List
⑩⑪⑫: Control Number



EMP-8-AN Part Markings

NOTICE

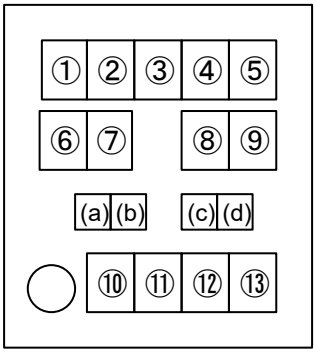
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI.

Part Marking List (EMP-8-AN)

Product Name	①	②	③	④	⑤	⑥	⑦	⑧	⑨
MUSES8921ANAE2S	M	U	S	E	S	8	9	2	1

■ MARKING SPECIFICATION (DFN4035-8-GR)

①②③④⑤⑥⑦⑧⑨: Product Cord Refer to Part Marking List
⑩⑪⑫⑬: Control Number
(a)(b)(c)(d): Control Number



DFN4035-8-GR Part Markings

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.

Part Marking List (DFN4035-8-GR)

Product Name	①	②	③	④	⑤	⑥	⑦	⑧	⑨
MUSES8921GRAE4S	M	U	S	E	S	8	9	2	1

■ REVISION HISTORY

Date	Revision	Contents of Changes
September 10, 2025	Ver. 1.0	Initial release

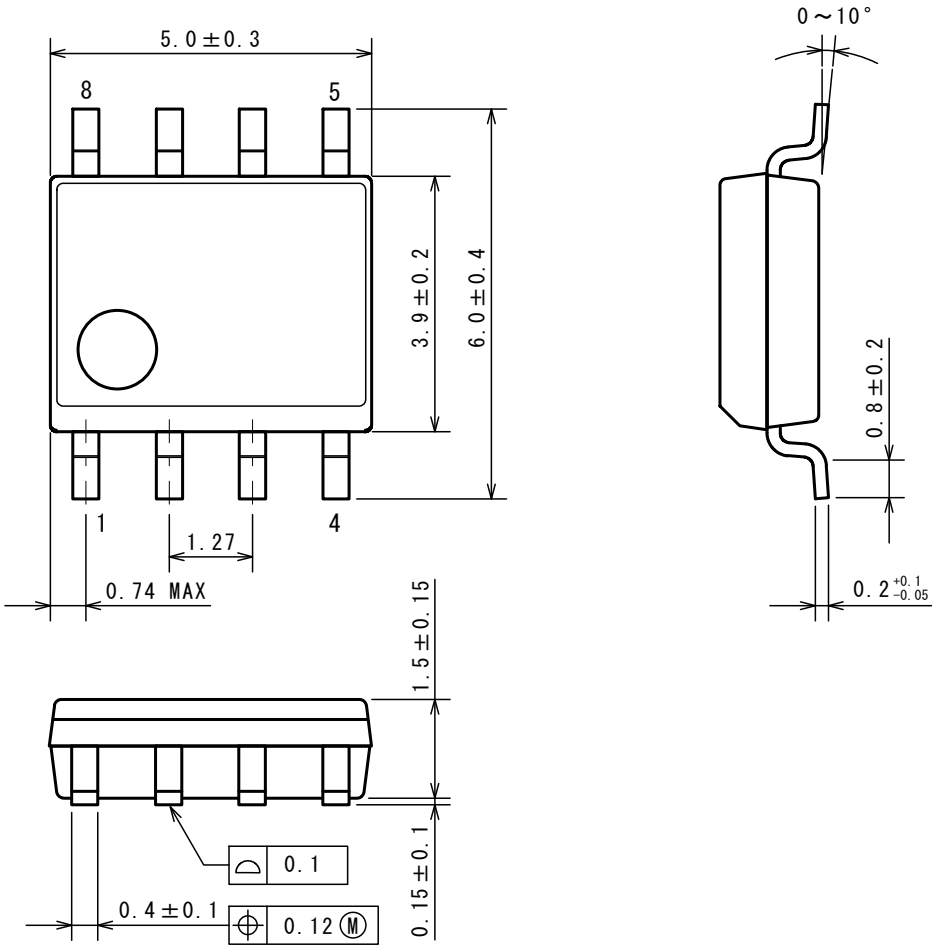
Nisshinbo Micro Devices Inc.

EMP-8-AN

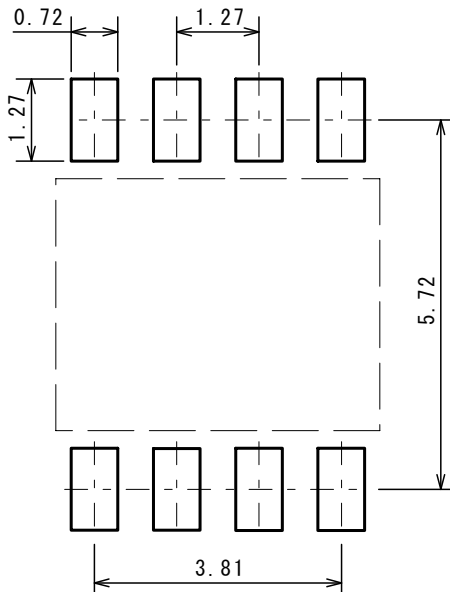
PI-EMP-8-AN-E-B

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



Nisshinbo Micro Devices Inc.

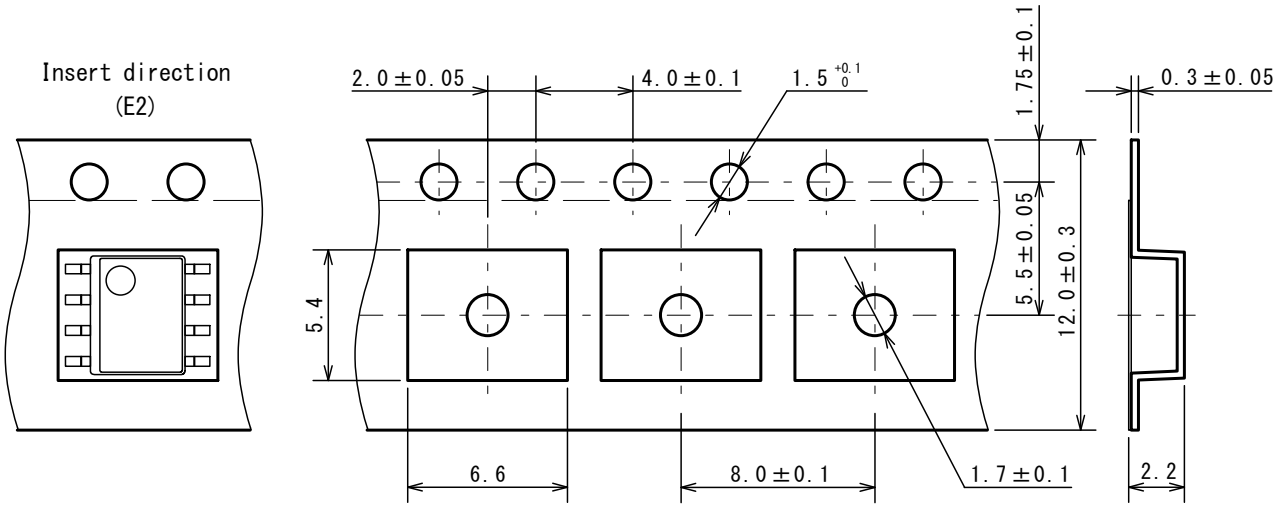
EMP-8-AN

PI-EMP-8-AN-E-B

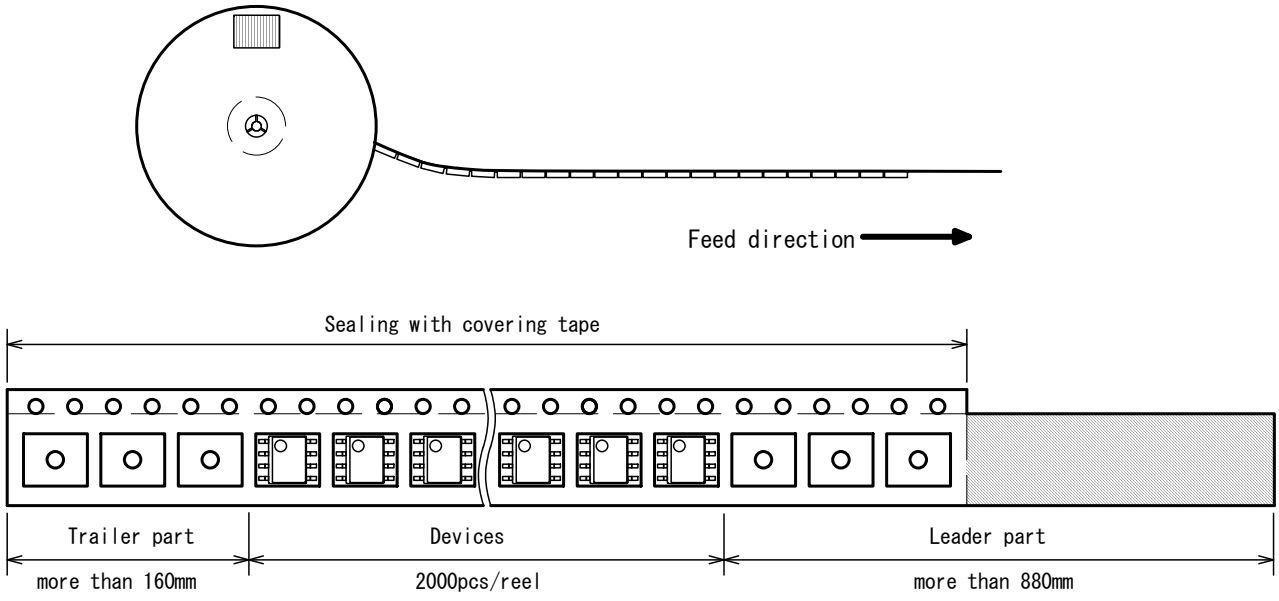
■ PACKING SPEC

UNIT: mm

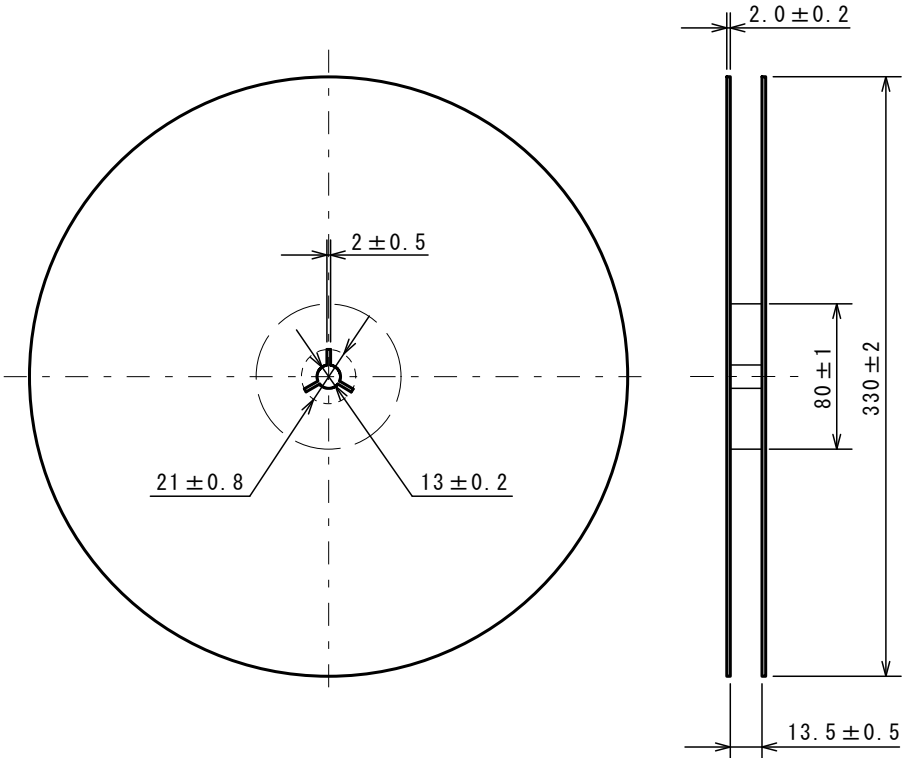
(1) Taping dimensions / Insert direction



(2) Taping state



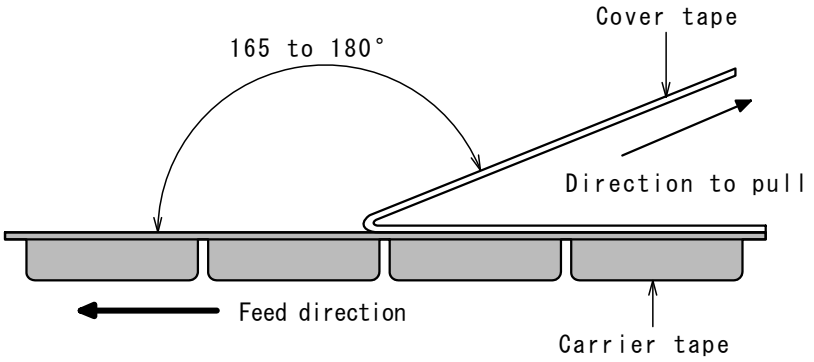
(3) Reel dimensions



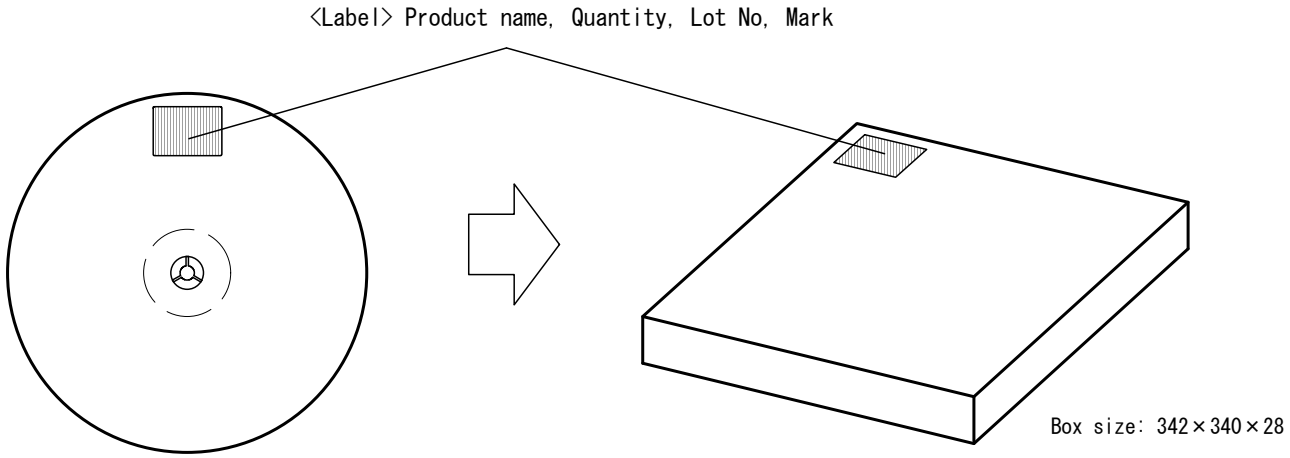
(4) Peeling strength

Peeling strength of cover tape

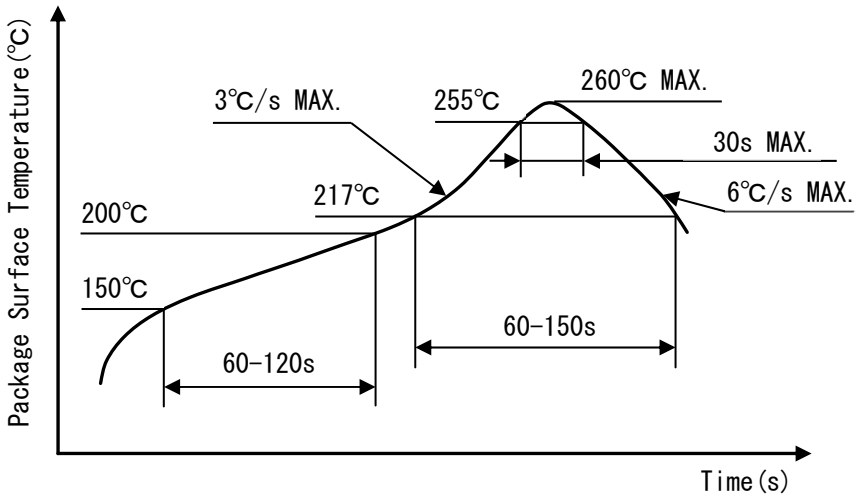
・Peeling angle	165 to 180° degrees to the taped surface.
・Peeling speed	300mm/min
・Peeling strength	0.1 to 1.3N



(5) Packing state



■ **HEAT-RESISTANCE PROFILES**



Reflow profile

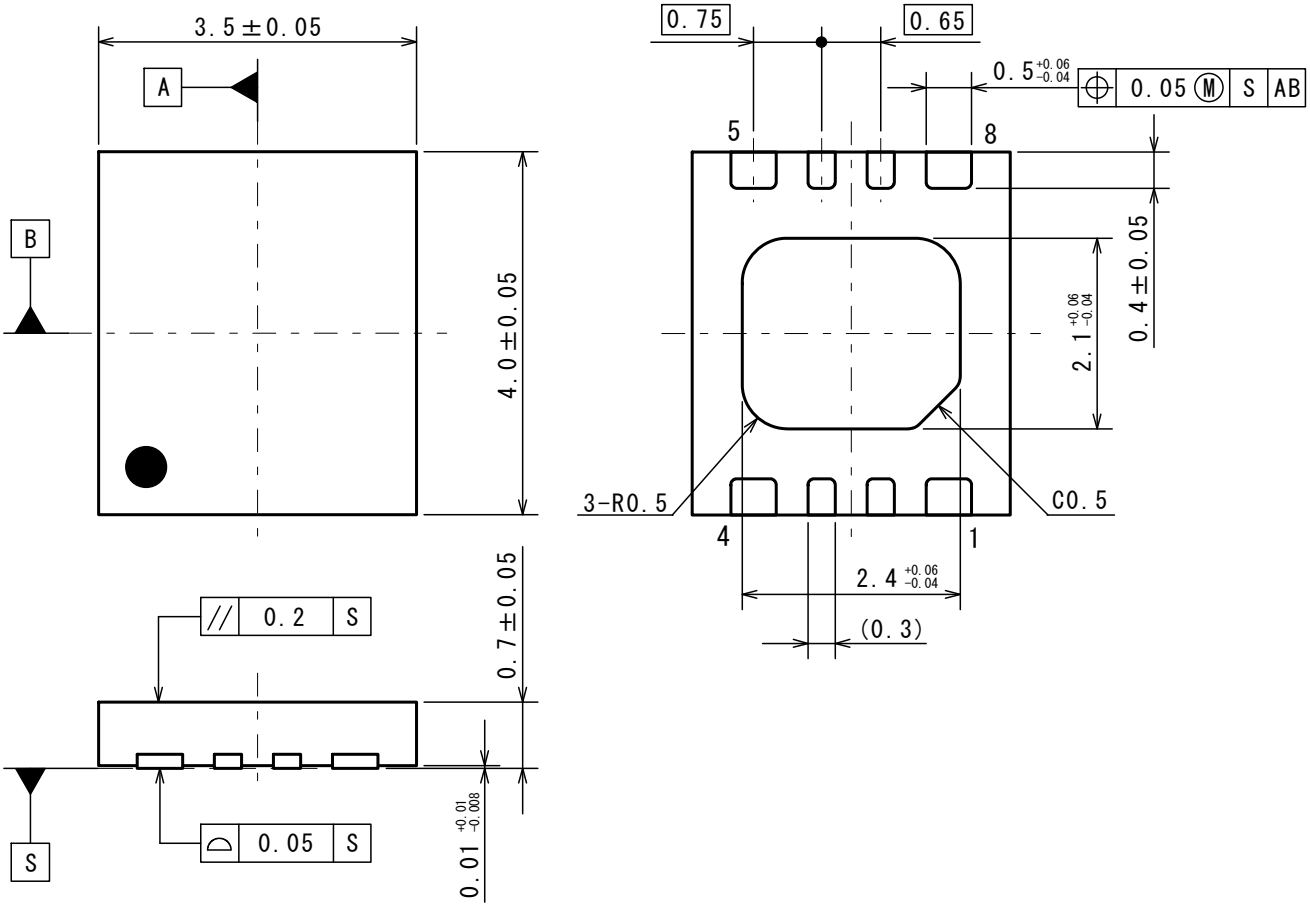
Nisshinbo Micro Devices Inc.

DFN4035-8-GR

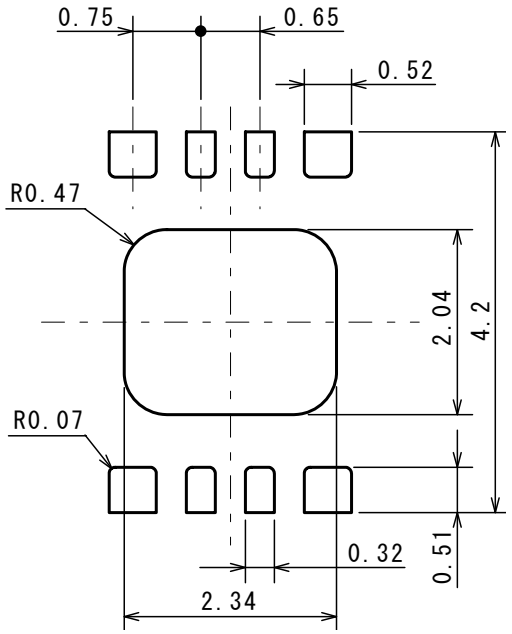
PI-DFN4035-8-GR-E-A

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



Nisshinbo Micro Devices Inc.

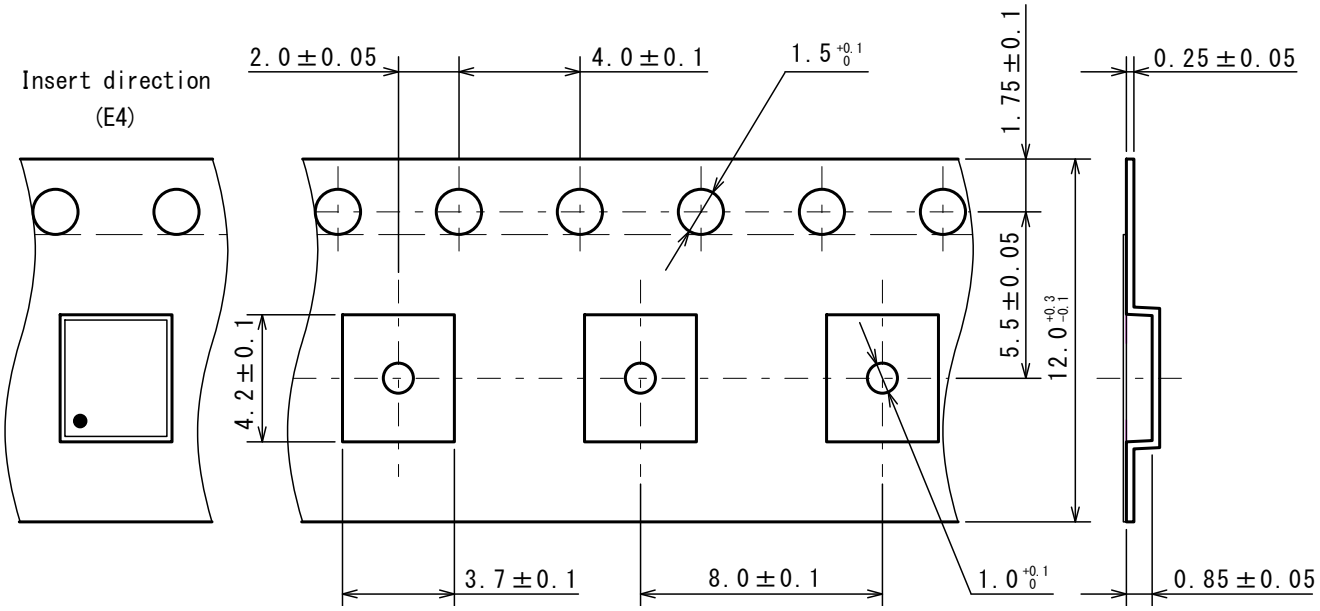
DFN4035-8-GR

PI-DFN4035-8-GR-E-A

■ PACKING SPEC

UNIT: mm

(1) Taping dimensions / Insert direction



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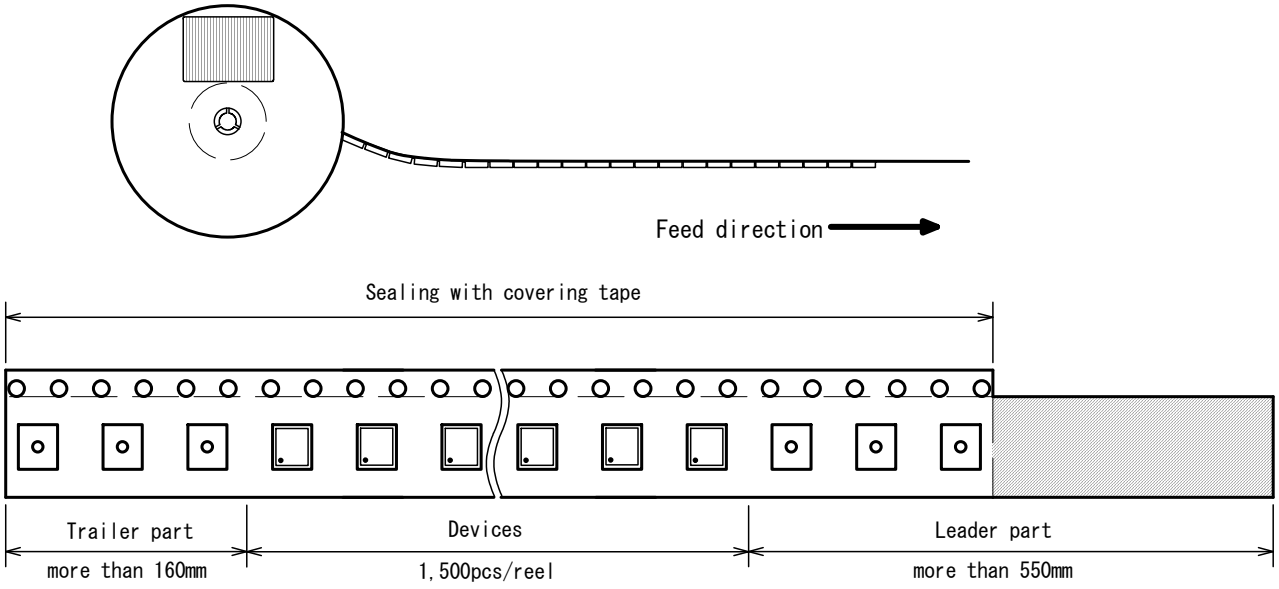
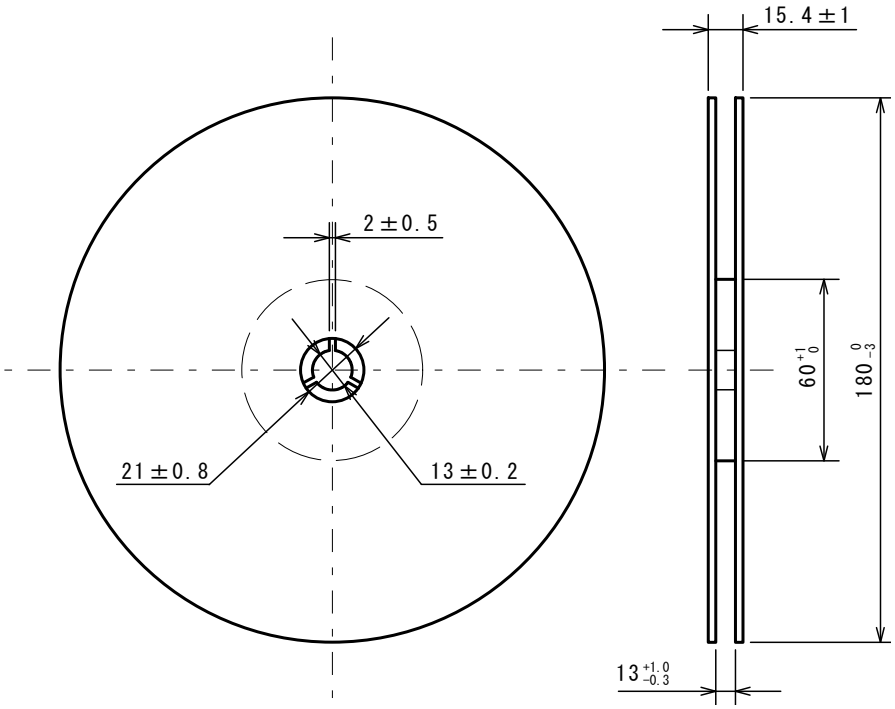


(3) Reel dimensions



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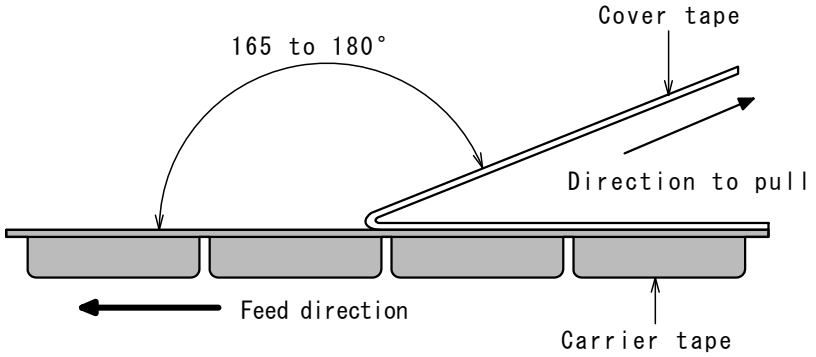
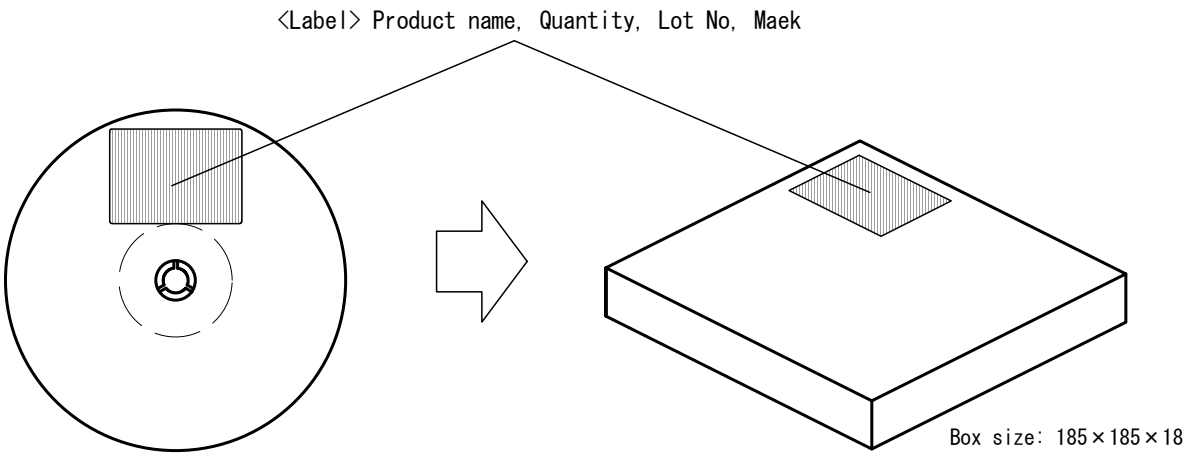
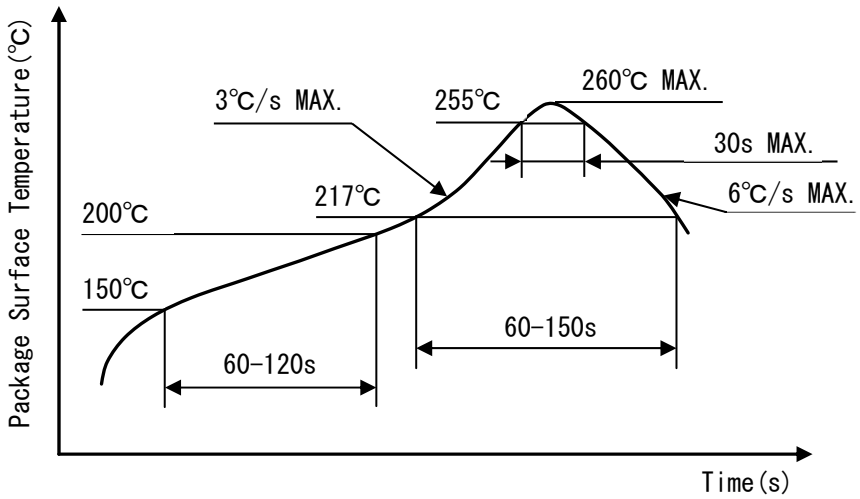


(5) Packing state



■ **HEAT-RESISTANCE PROFILES**



Reflow profile

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    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.
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13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.

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