



NL8802

High Quality Sound Dual Operational Amplifier

FEATURES

- High Quality Sound
- Wide Operating Voltage Range $\pm 3.0\text{V}$ to $\pm 22\text{V}$
- Low Noise $5.5\text{nV}/\sqrt{\text{Hz}}$ at $f=1\text{kHz}$
- Low Distortion 0.00005% at $f=1\text{kHz}$
- Wide Gain Bandwidth Product 45MHz
- High Slew Rate $11\text{V}/\mu\text{s}$
- Quiescent Current 8.0mA (Dual)
- Bipolar Input
- Bipolar Technology
- Package Outline EMP-8-AN
(Under development) DFN3030-8-GQ

DESCRIPTION

The NL8802 is a high quality sound dual audio operational amplifier that applies the high quality sound technology of "MUSES" to a more productive technology.

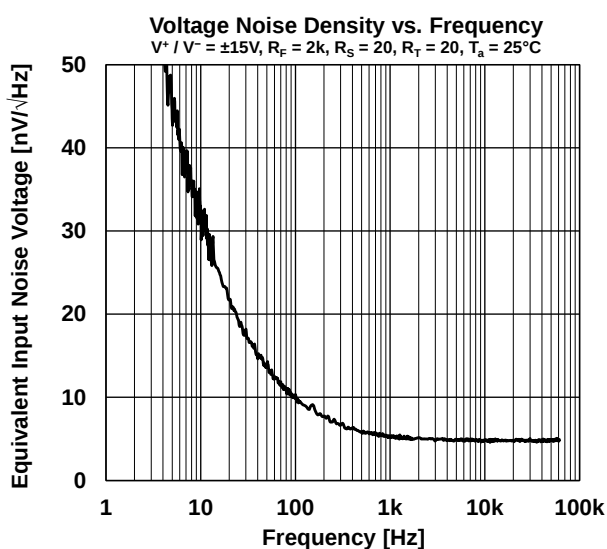
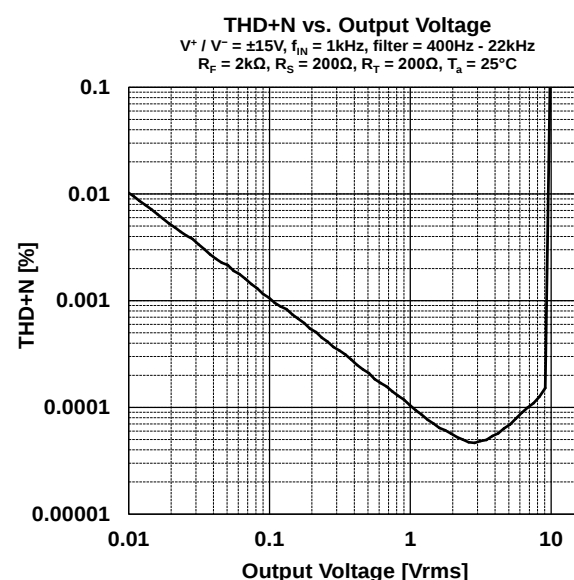
The NL8802 features wide operating voltage range, low noise, low distortion, wide bandwidth and high slew rate.

It is the best for audio preamplifiers, active filters and line amplifiers.

APPLICATIONS

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

THD+N and Noise



■ PRODUCT NAME INFORMATION

NL8802 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 GQ: DFN3030-8-GQ
A	Version	Indicates the product version. "A" is initial version.
bb	Packing	Refer to the packing specifications.
S	Grade	Indicates the quality grade. "S" means general-purpose and consumer application.

Grade

	Applications	Operating Temperature Range	Test Temperature
S	General-purpose and Consumer application	-40°C to 85°C -40°C to 105°C *1	25°C

*1 Recommended Operating Conditions (Operating Temperature2)

■ ORDER INFORMATION

Product Name	Package	RoHS	Halogen-Free	Terminal Finish	Weight (mg)	QUANTITY PER REEL (pcs/reel)
NL8802ANAE1S	EMP-8-AN	✓	✓	Sn2Bi	76	2000
NL8802GQAE3S (Under development)	DFN3030-8-GQ	✓	✓	Sn2Bi	18	1500

■ PIN DESCRIPTIONS

Product Name	NL8802AN	NL8802GQ
Package	EMP-8-AN	DFN3030-8-GQ
Pin Functions	(Top View) A OUTPUT 1, A -INPUT 2, A +INPUT 3, V- 4, V+ 8, B OUTPUT 7, B -INPUT 6, B +INPUT 5	(Top View) A OUTPUT 1, A -INPUT 2, A +INPUT 3, V- 4, V+ 8, B OUTPUT 7, B -INPUT 6, B +INPUT 5 *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

Parameter	Symbol	Rating	Unit
Supply Voltage ($V_s = V^+ - V^-$)	V^+ / V^-	± 22 (44)	V
Input Voltage ^{*1}	V_{IN}	$V^- - 0.3$ to $V^- + 44$	V
Differential Input Voltage ^{*2}	V_{ID}	± 0.5	V
Input Current ^{*3}	I_{IN}	± 10	mA
Storage Temperature	T_{stg}	-50 to 150	°C
Junction Temperature ^{*4}	T_j	150	°C

^{*1} Input voltage is the voltage should be allowed to apply to the input terminal independent of the magnitude of V^+ .

The normal operation will establish when any input is within the Common Mode Input Voltage Range of electrical characteristics.

^{*2} Differential input voltage is the voltage difference between +INPUT and -INPUT.

^{*3} Excessive input current will flow if a differential input voltage in excess of approximately 0.5 V is applied between the inputs, unless some limiting resistance is used.

^{*4} Calculate the power consumption of the IC from the operating conditions, and calculate the junction temperature with the thermal resistance. 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 (θ_{ja})	Thermal Characterization Parameter (ψ_{jt})	
EMP-8-AN	157 ^{*1} / 103 ^{*2}	16 ^{*1} / 12 ^{*2}	°C/W
DFN3030-8-GQ	192 ^{*3} / 60 ^{*4}	-	

θ_{ja} : Junction-to-Ambient Thermal Resistance

ψ_{jt} : 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 (EMP-8-AN)

	Conditions	Protection Voltage
HBM	$C = 100$ pF, $R = 1.5$ k Ω	± 2000 V
CDM		± 750 V (Corner pins) ± 500 V (Other pins)

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	Conditions	Rating	Unit
Supply Voltage	V^+ / V^-		± 3.0 to ± 22	V
Operating Temperature1	T_{a1}		-40 to 85	°C
Operating Temperature2	T_{a2}	EMP-8-AN ^{*1}	-40 to +105	°C
		$V^+ / V^- \leq \pm 13V$ DFN3030-8-GQ ^{*2}		

^{*1} 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).

^{*2} 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.)

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.

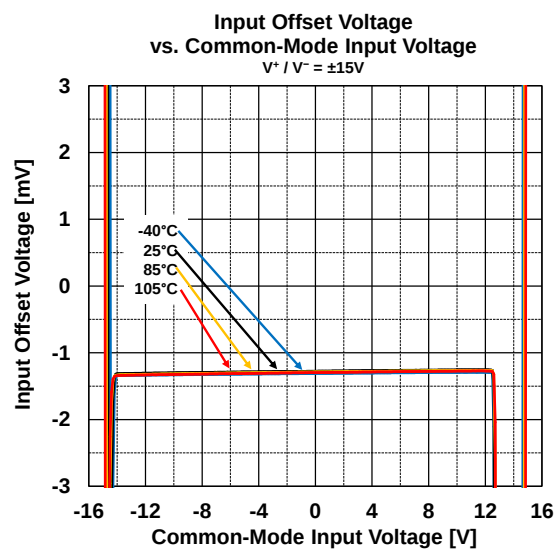
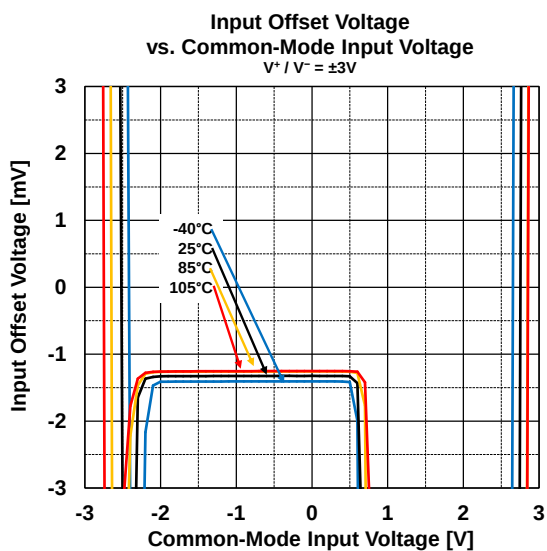
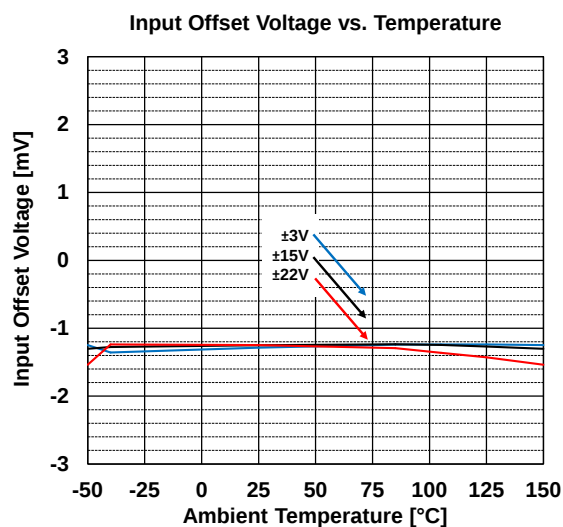
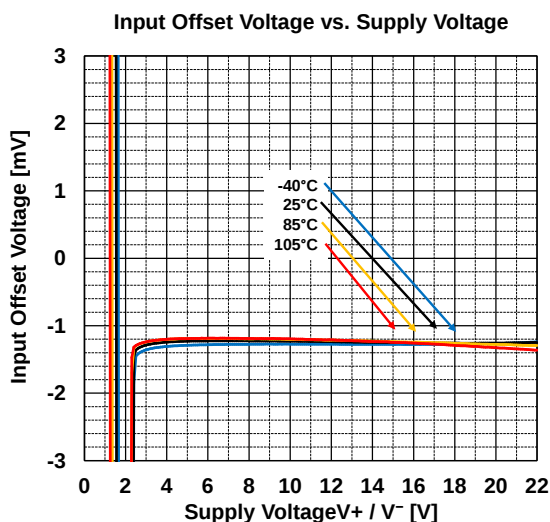
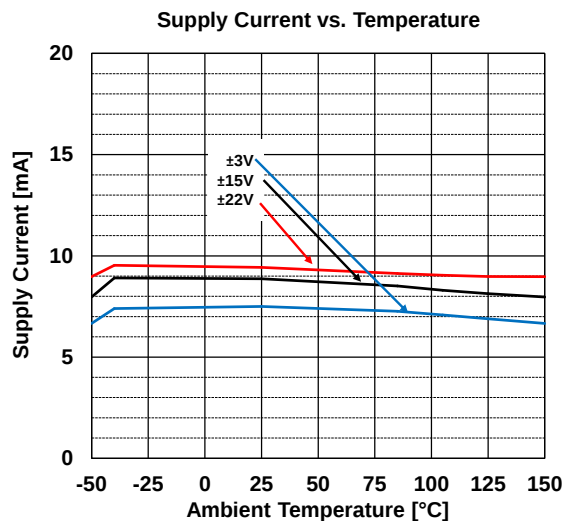
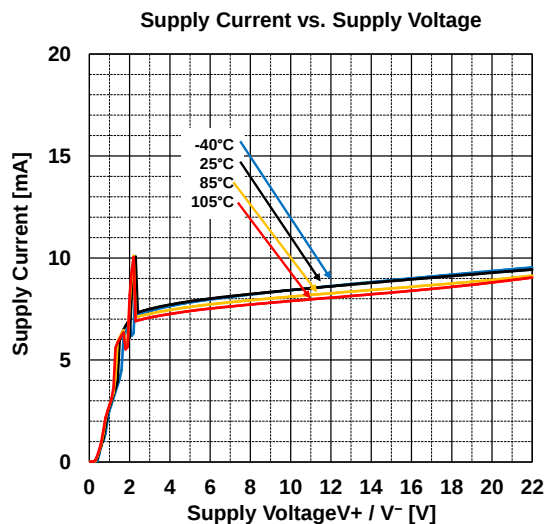
■ ELECTRICAL CHARACTERISTICS

$V^+ / V^- = \pm 15V$, R_L to GND, $T_a = 25^\circ C$, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
DC CHARACTERISTICS						
Supply Current	I_{CC}	No Signal, $R_L = \infty$	-	8.0	16	mA
Input Offset Voltage	V_{IO}	$R_S = 50\Omega$	-	1.0	5.0	mV
Input Bias Current	I_B		-	0.5	1.8	μA
Input Offset Current	I_{IO}		-	10	300	nA
Open-Loop Voltage Gain 1	A_{V1}	$R_L = 10k\Omega$, $V_O = \pm 10V$	90	115	-	dB
Open-Loop Voltage Gain 2	A_{V2}	$R_L = 600\Omega$, $V_O = \pm 10V$	80	104	-	dB
Common Mode Rejection Ratio	CMR	$V_{ICM} = \pm 12V$	80	115	-	dB
Supply Voltage Rejection Ratio	SVR	$V^+ / V^- = \pm 3.0$ to $\pm 22V$	80	110	-	dB
Maximum Output Voltage 1	V_{OM1}	$R_L = 600\Omega$	± 12	± 13	-	V
Maximum Output Voltage 2	V_{OM2}	$V^+ / V^- = \pm 18V$, $R_L = 600\Omega$	± 15	± 16	-	V
Common Mode Input Voltage Range	V_{ICM}	CMR $\geq 80dB$	± 12	± 13	-	V
Input Resistance	R_{IN}		-	50	-	k Ω
Short-circuit Output Current	I_O		30	60	-	mA
AC CHARACTERISTICS						
Gain Bandwidth Product	GBW	$f = 100kHz$	-	45	-	MHz
Unity Gain Frequency	f_T	$A_V = +100$, $R_S = 100\Omega$, $R_L = 2k\Omega$, $C_L = 10pF$	-	16	-	MHz
Phase Margin	Φ_M	$A_V = +100$, $R_S = 100\Omega$, $R_L = 2k\Omega$, $C_L = 10pF$	-	70	-	Deg
Slew Rate	SR	$A_V = +10$, $V_{IN} = 0.5V_{p-p}$, $R_L = 2k\Omega$, $C_L = 10pF$	-	11	-	V/ μs
Total Harmonic Distortion	THD	$f = 1kHz$, $A_V = +10$, $V_O = 3V_{rms}$, $R_L = 2k\Omega$	-	0.00005	-	%
Input Noise Voltage1	e_n	$f = 1kHz$	-	5.5	-	nV/ $\sqrt{Hz}$
Input Noise Voltage2	V_{NI}	$f = 20Hz$ to $20kHz$	-	0.9	-	μV_{rms}

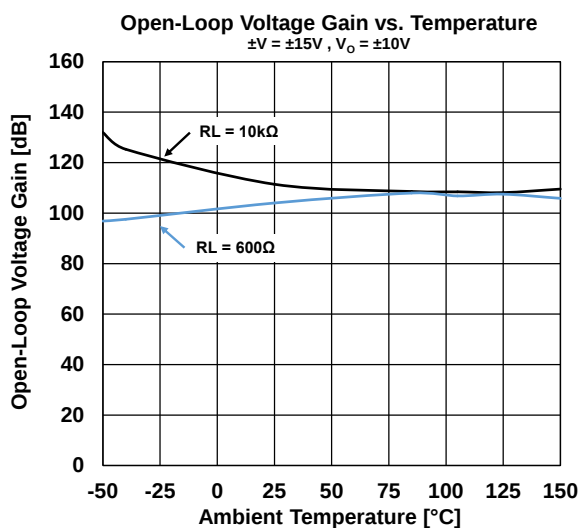
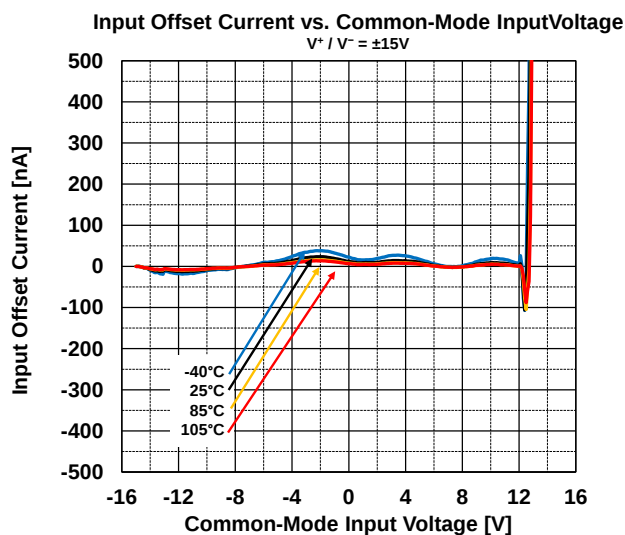
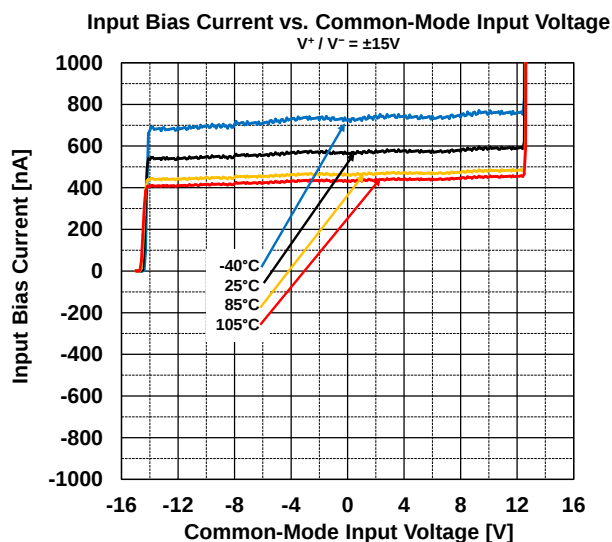
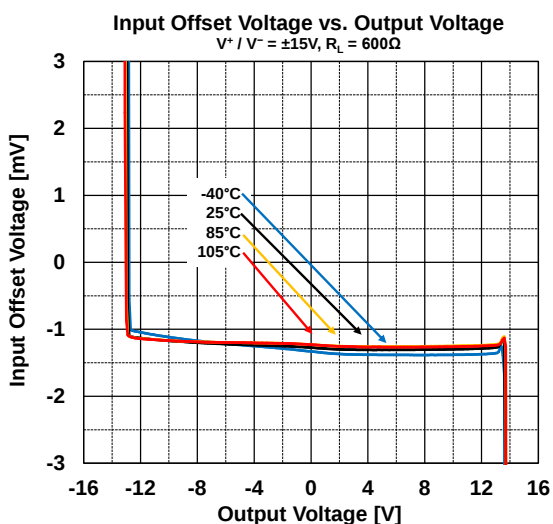
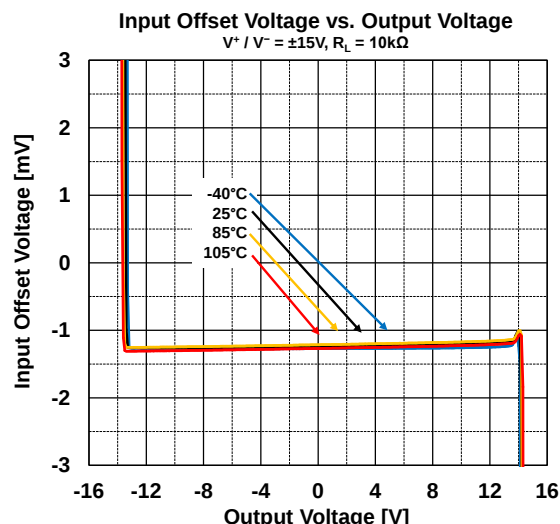
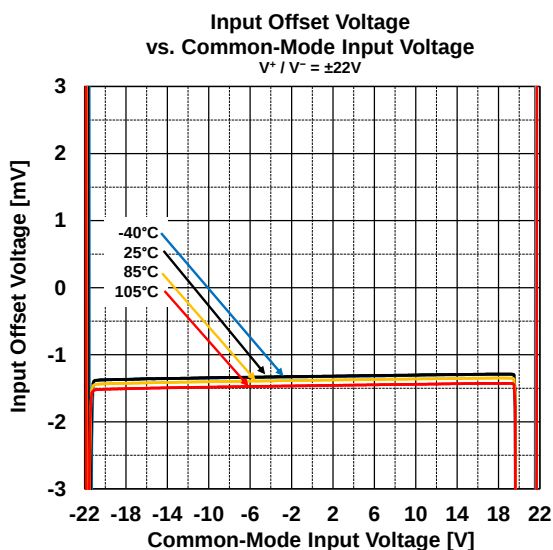
■ TYPICAL CHARACTERISTICS

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



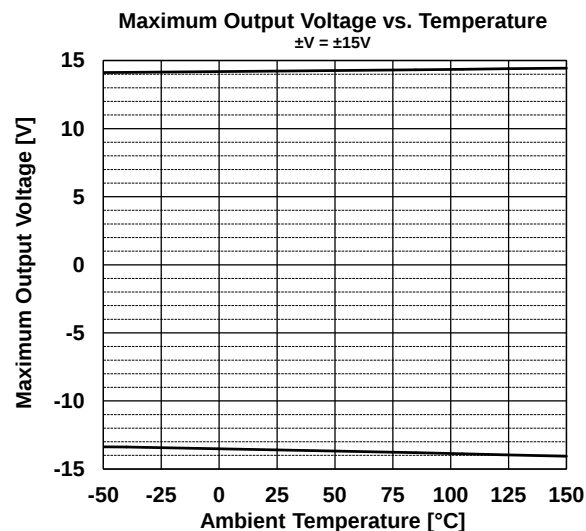
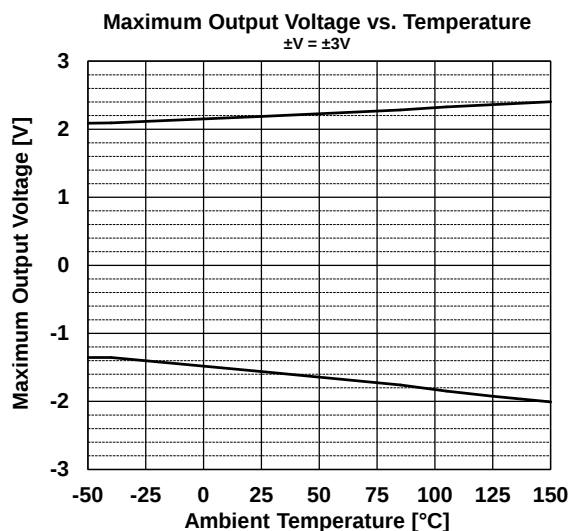
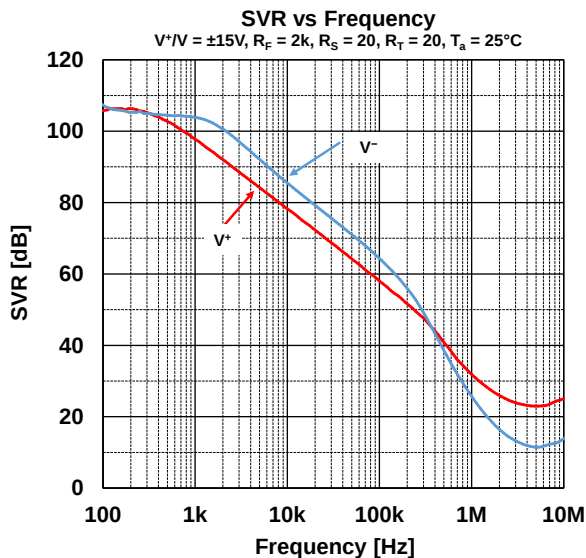
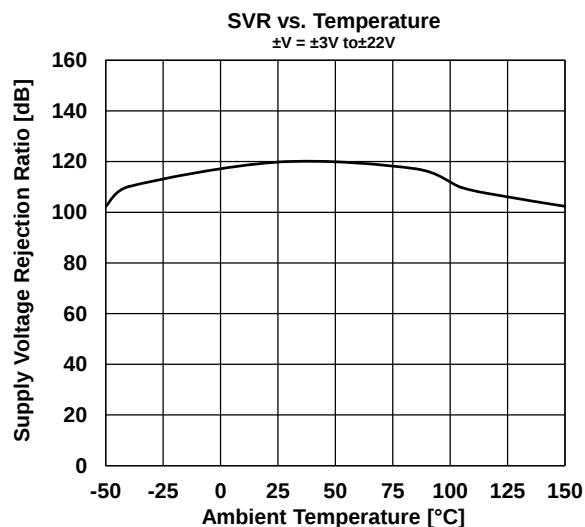
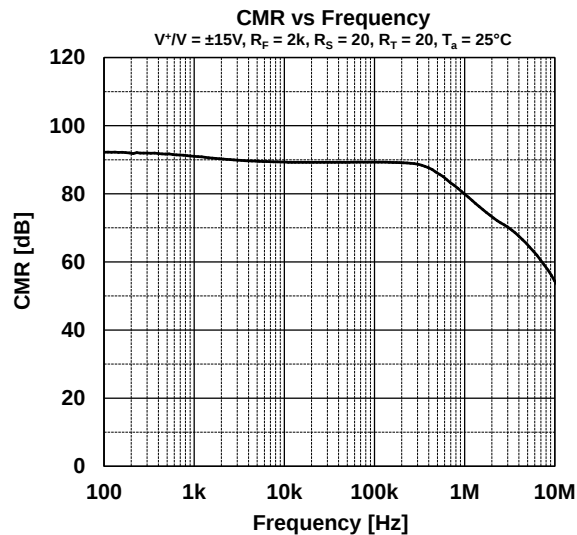
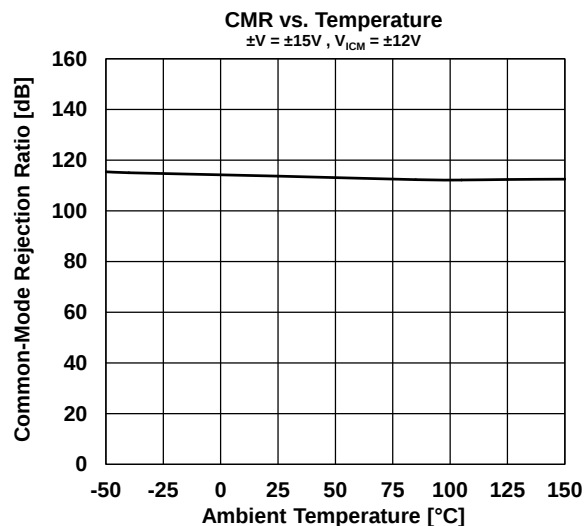
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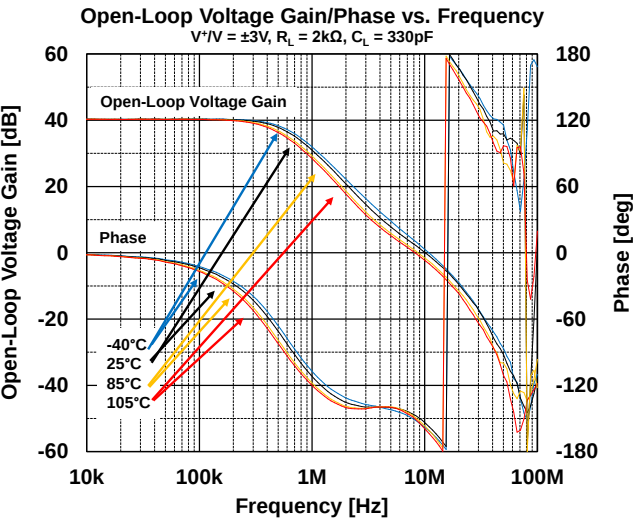
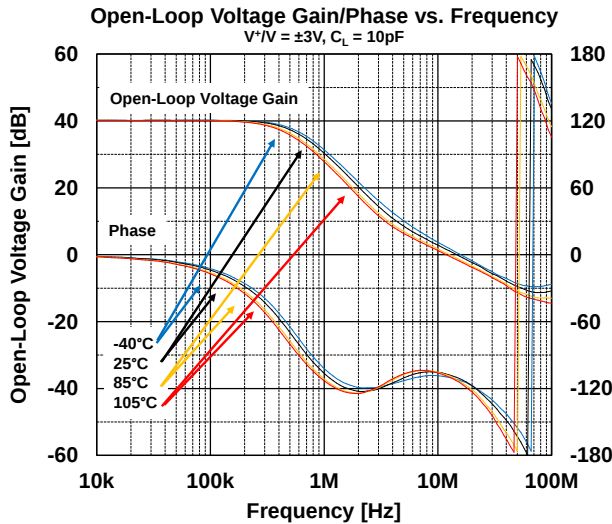
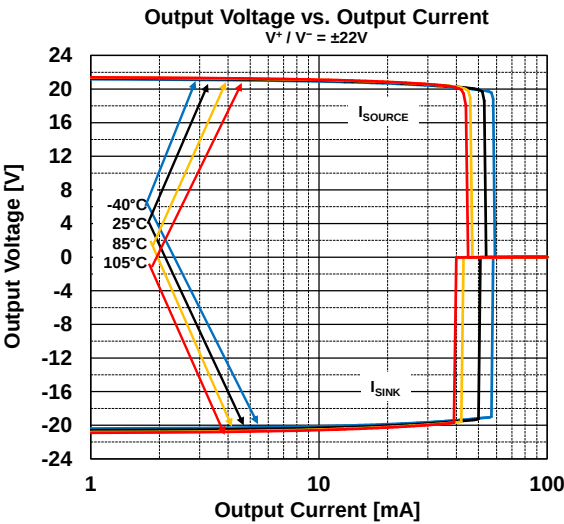
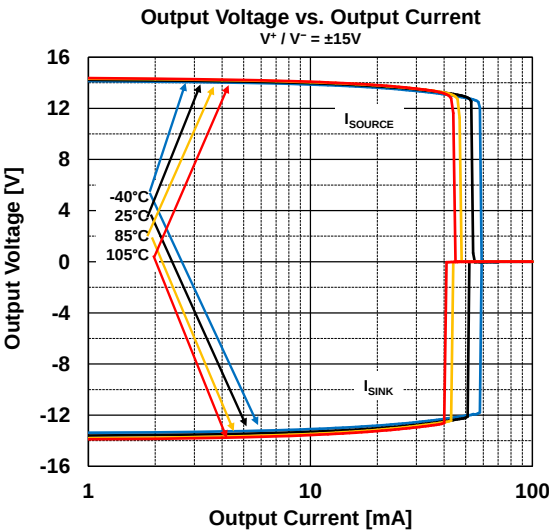
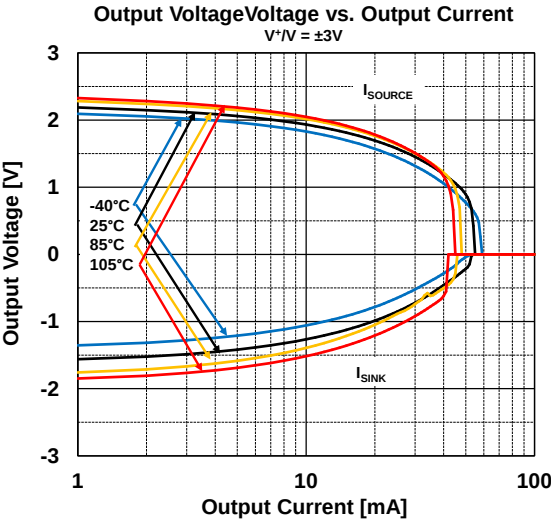
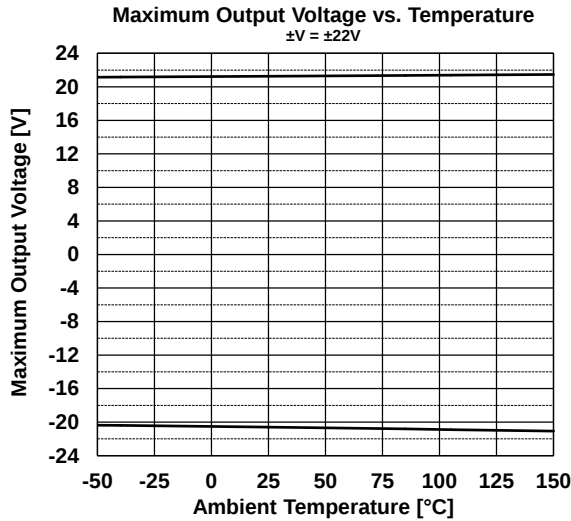
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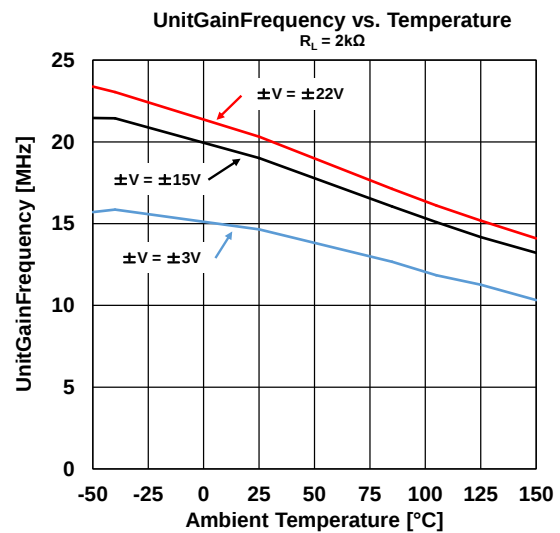
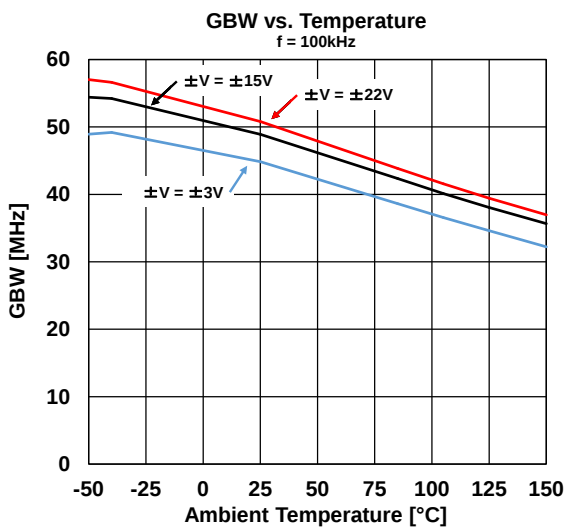
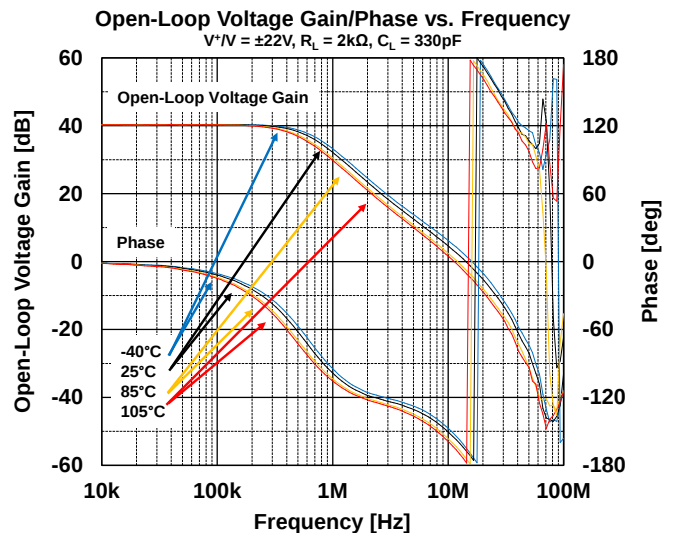
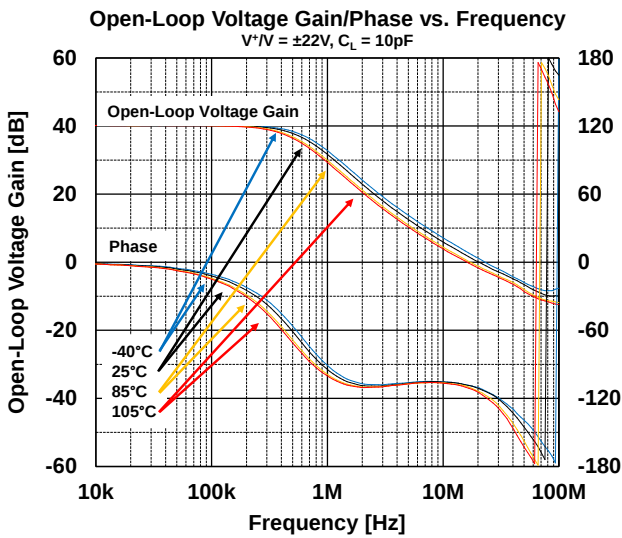
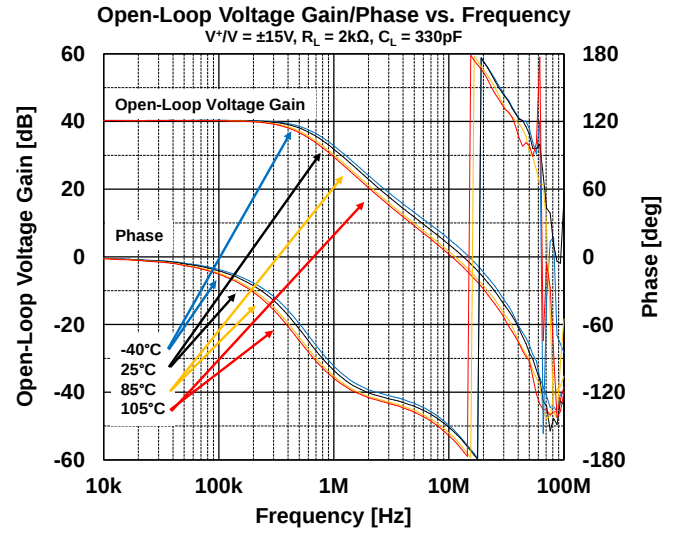
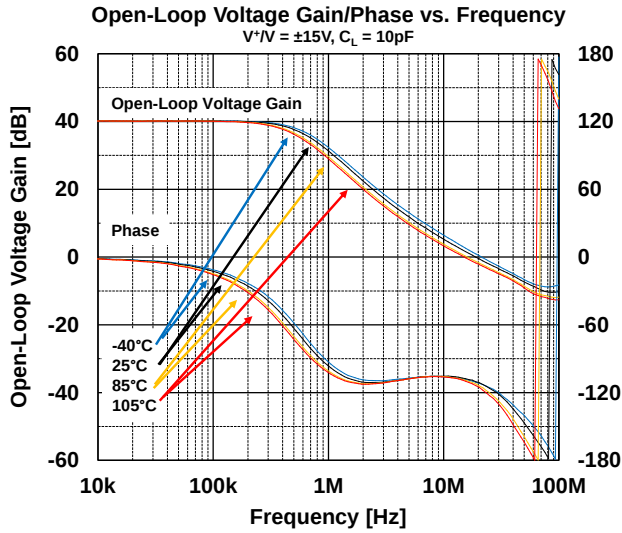
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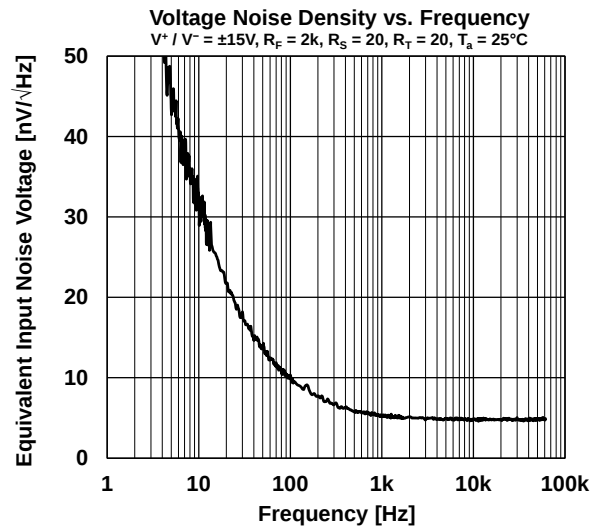
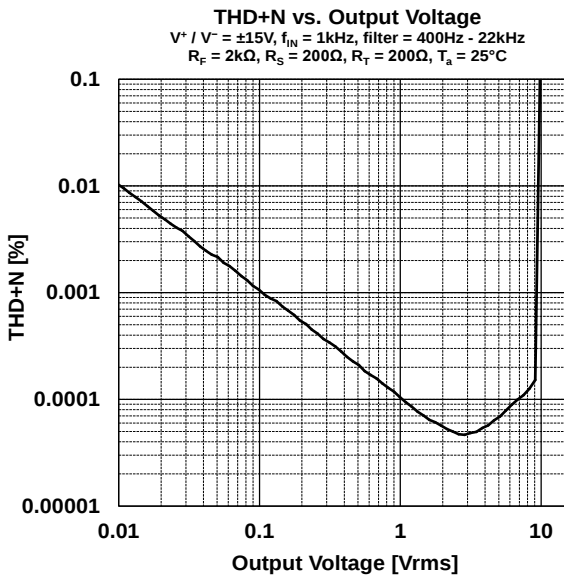
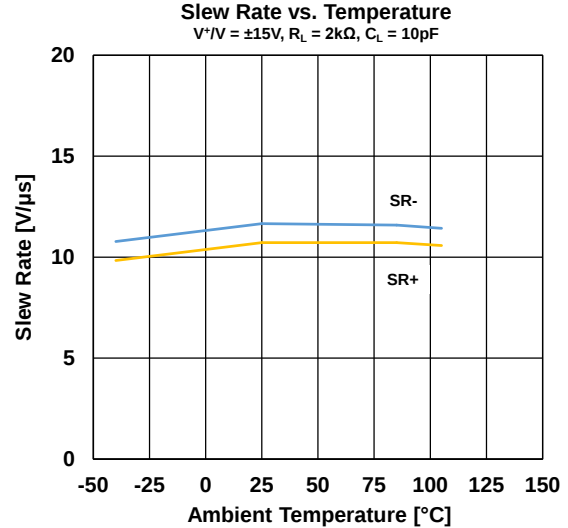
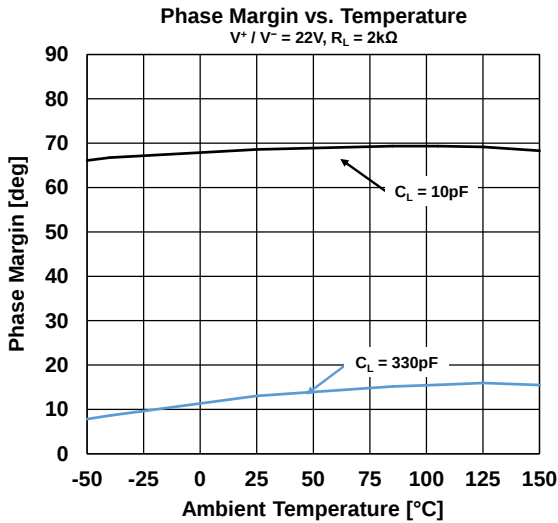
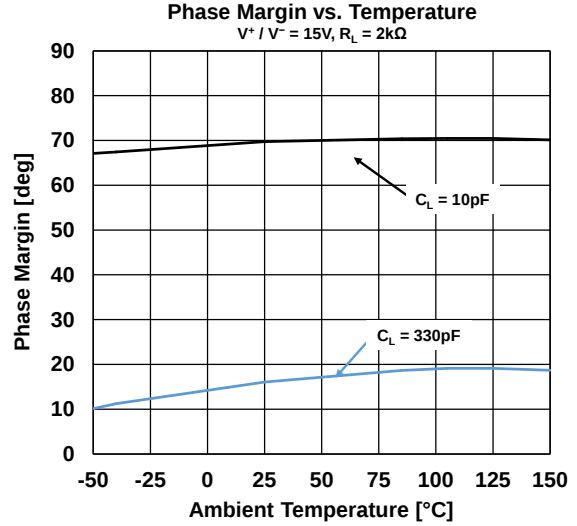
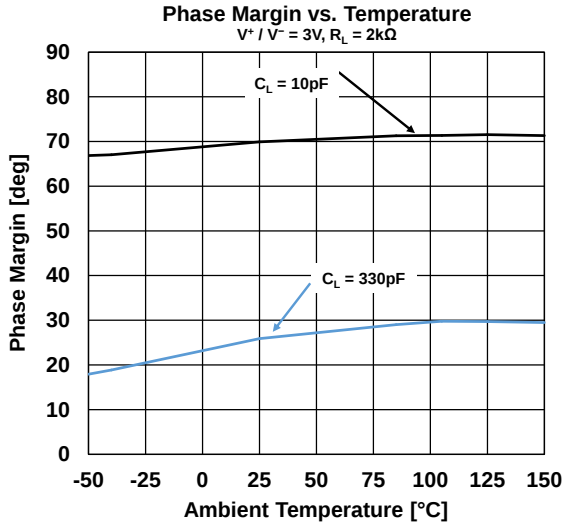
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■ TEST CIRCUITS

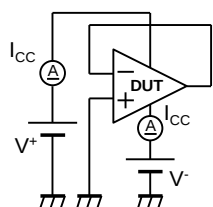


Figure 1. Supply Current

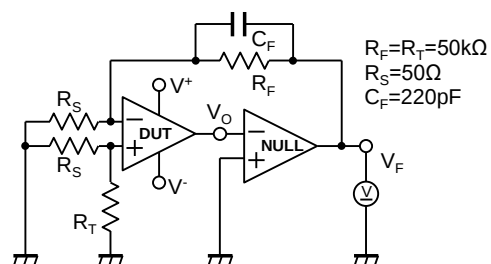


Figure 2. Input Offset Voltage

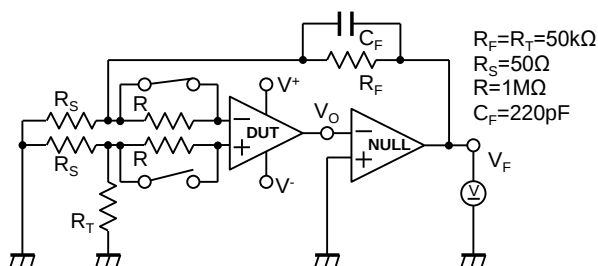


Figure 3. Input Bias Current

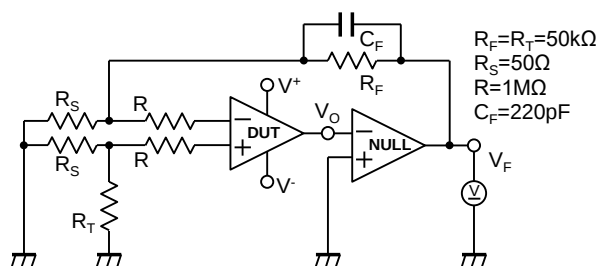


Figure 4. Input Offset Current

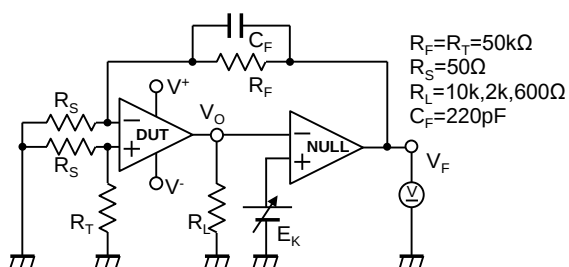


Figure 5. Open-Loop Voltage Gain

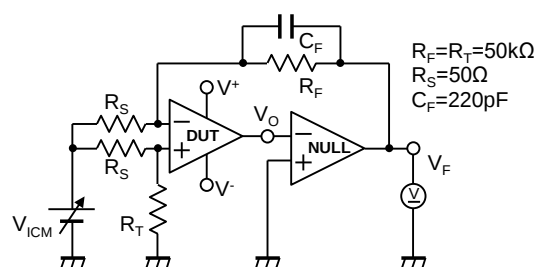


Figure 6. Common Mode Rejection Ratio

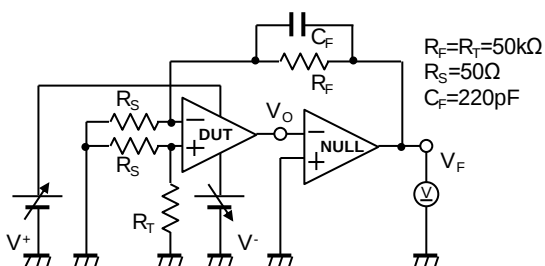


Figure 7. Supply Voltage Rejection Ratio

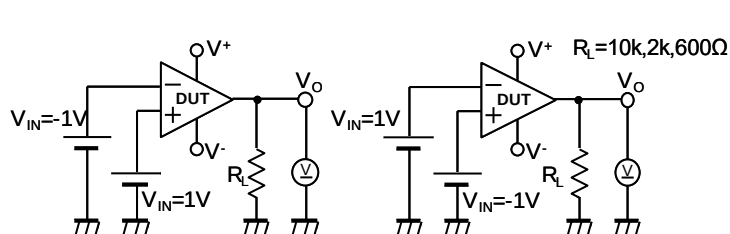


Figure 8. Maximum Output Voltage

■ TEST CIRCUITS

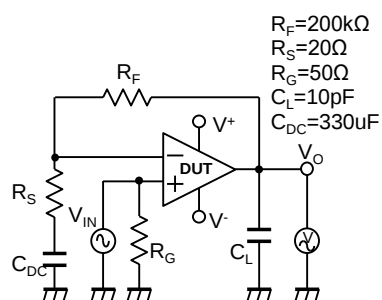


Figure 9. Gain Bandwidth Product

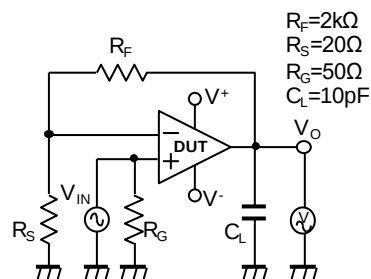


Figure 10. Unity Gain Frequency, Phase Margin

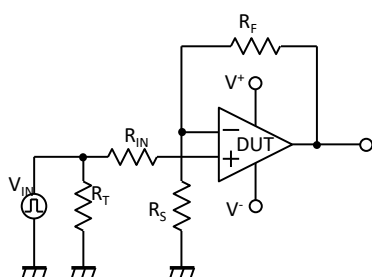


Figure 11. Slew Rate

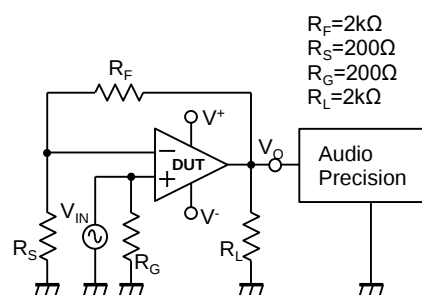


Figure 12. Total Harmonic Distortion

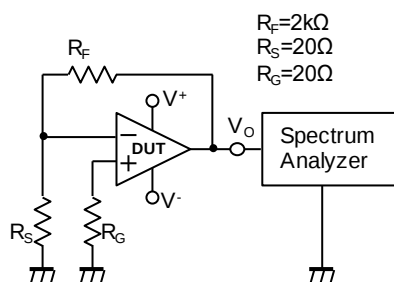
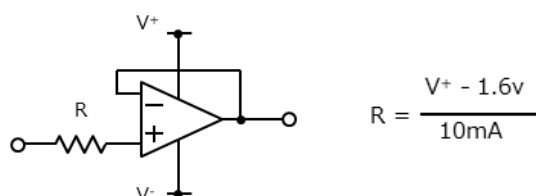


Figure 13. Input Noise Voltage

■ APPLICATION NOTE

Internal Diode Protection

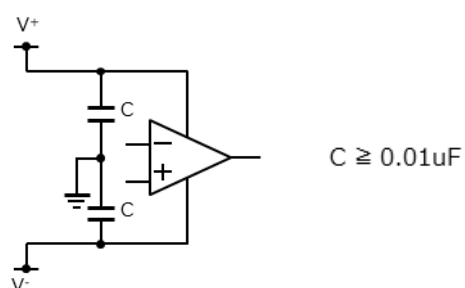
When using in a voltage follower circuit, insert a current limiting resistor into the input terminal as shown in Figure 1 to avoid destroying the internal input diode when the power is turned on.



(Figure 1)

Oscillation Countermeasures

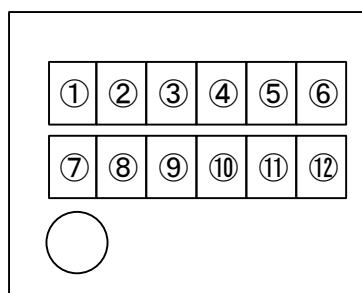
The device may oscillate due to Power wiring resistance. Place the bypass capacitor in Figure 2 close to the device.



(Figure 2)

■ MARKING SPECIFICATION (EMP-8-AN)

①②③④⑤⑥⑦⑧: Product Cord Refer to Part Marking List
⑨⑩⑪⑫: 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)

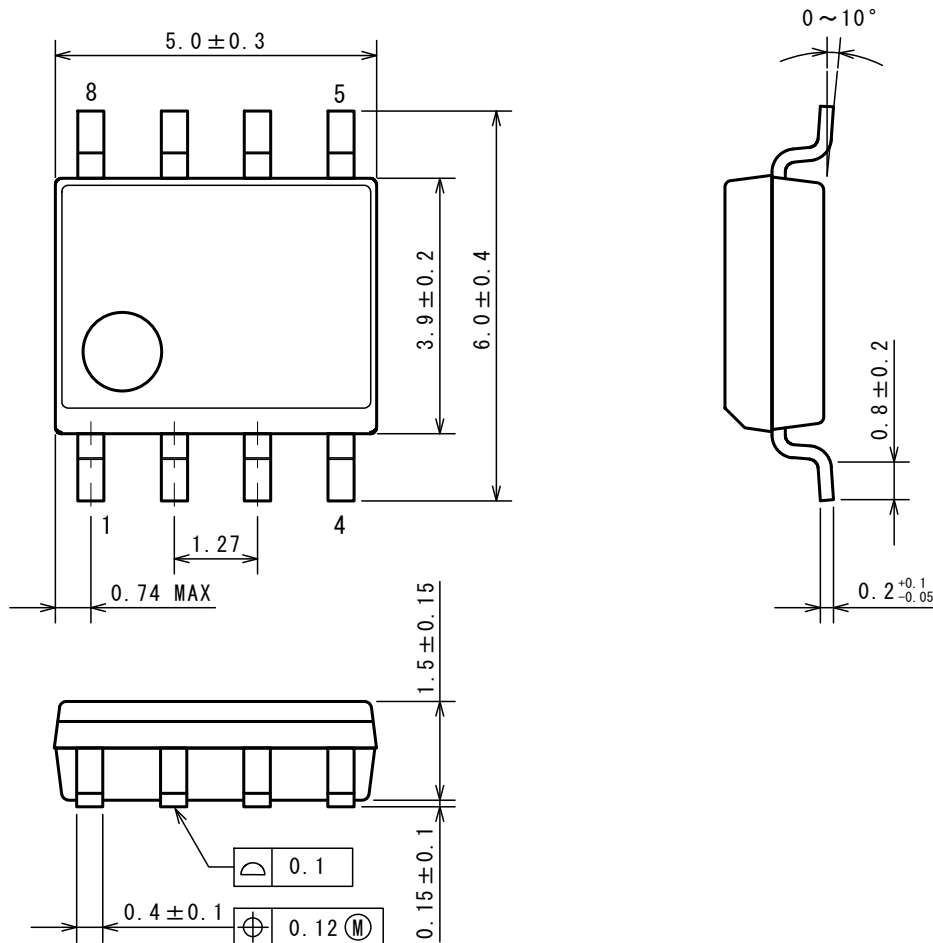
Product Name	①	②	③	④	⑤	⑥	⑦	⑧
NL8802ANAE1S	L	8	8	0	2	A	S	A

■ REVISION HISTORY

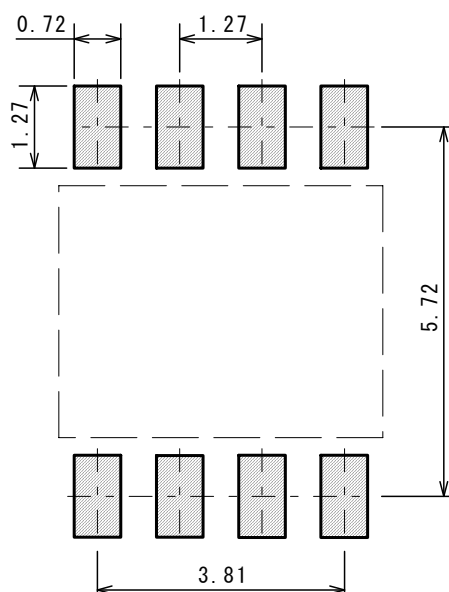
Date	Revision	Contents of Changes
October 30, 2023	Ver. 1.0	Initial release

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



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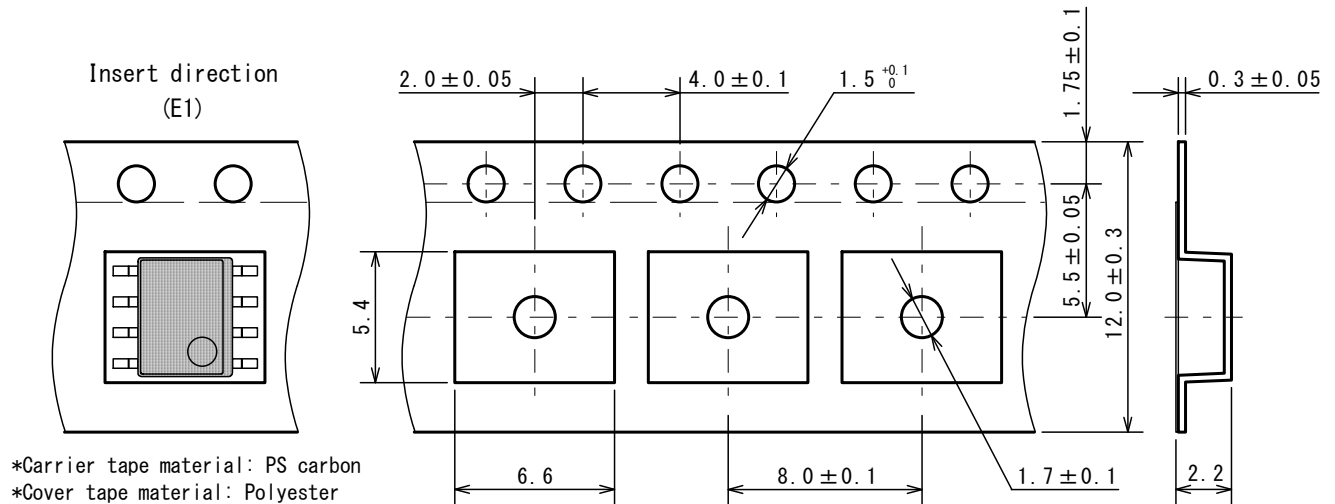
EMP-8-AN

PI-EMP-8-AN-E-A

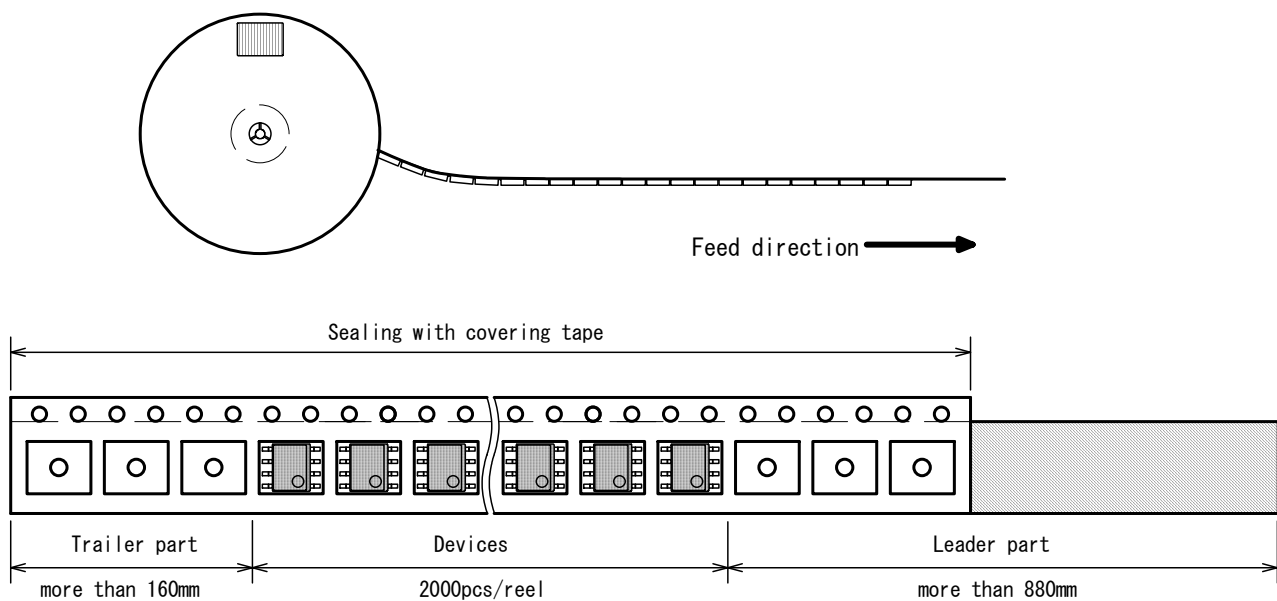
■ PACKING SPEC

UNIT: mm

(1) Taping dimensions / Insert direction



(2) Taping state

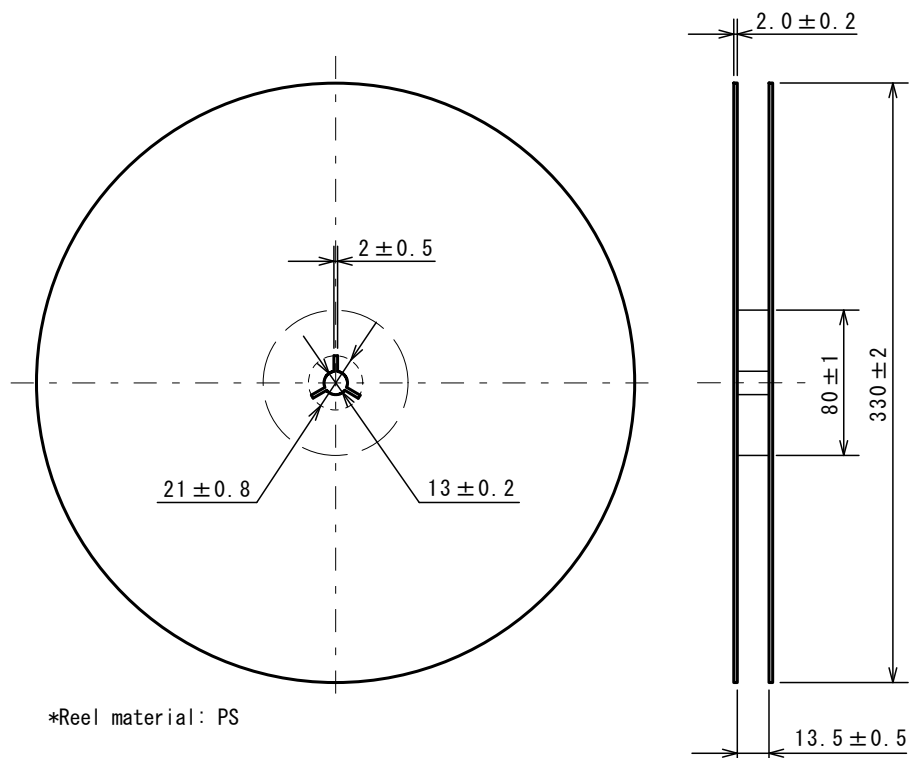


Nisshinbo Micro Devices Inc.

EMP-8-AN

PI-EMP-8-AN-E-A

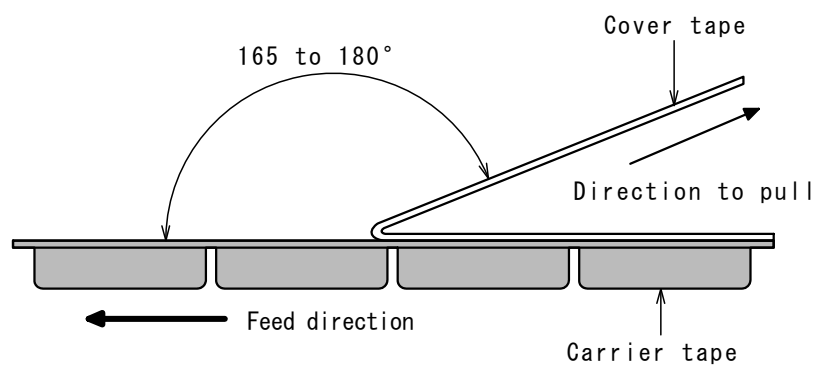
(3) Reel dimensions



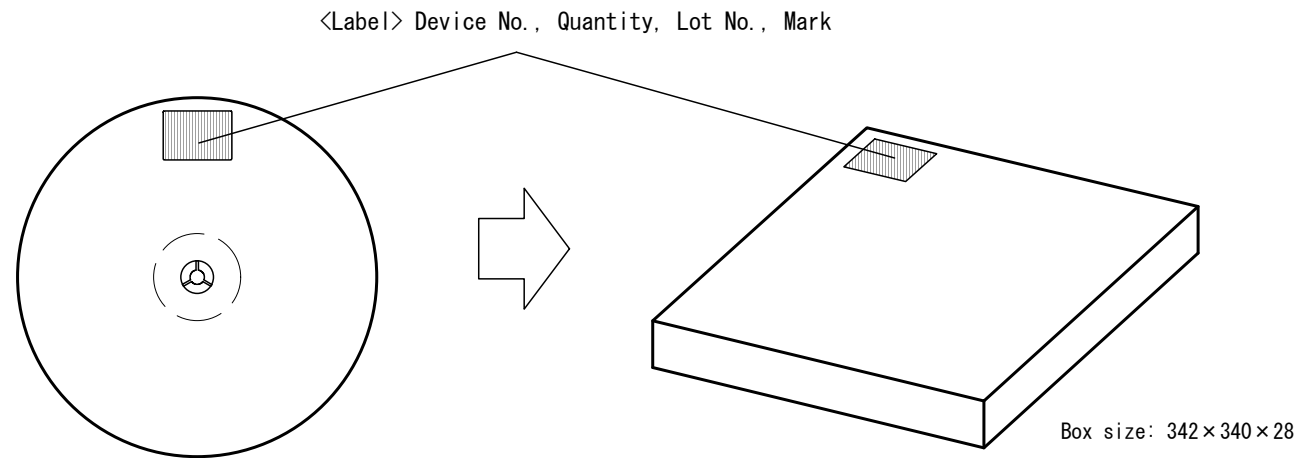
(4) Peeling strength

Peeling strength of cover tape

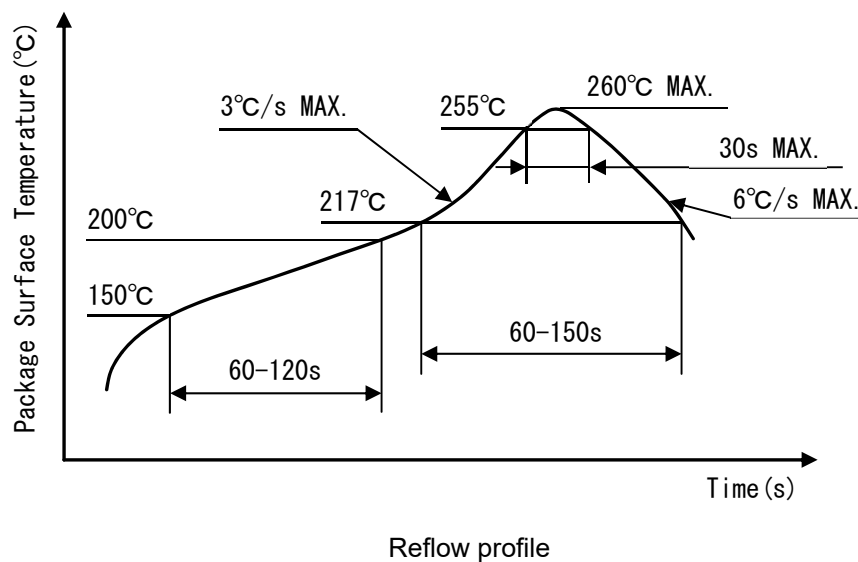
- Peeling angle 165 to 180° degrees to the taped surface.
- Peeling speed 300mm/min
- Peeling strength 0.1 to 1.3N



(5) Packing state



■ HEAT-RESISTANCE PROFILES



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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