

NT9002HDAE4S

Diode for 1mW Class Rectifier

FEATURES

- High reverse voltage*: 20 V
- Low forward voltage: 0.1 V typ. @ $I_F = 2 \mu A$
- Low reverse leakage current: 0.5 μA typ. @ $V_R = 2 V$
- Low series resistance: 110 Ω typ.
@ $V_F = 0.85 \pm 0.01 V$
- Low total capacitance: 0.025 pF typ.
@ $V_R = 2 V, f = 100 MHz$
- Package size: 1.2 x 1.2 mm typ.
 $t = 0.427 mm$ max.
- RoHS compliant, Halogen free, MSL1

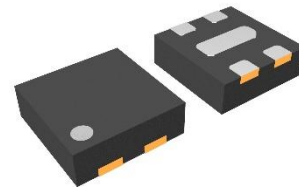
* Absolute maximum ratings

GENERAL DESCRIPTION

The NT9002HDAE4S is a 1 mW-class rectifier diode optimized for rectifier circuits in microwave WPT operating in the 920 MHz, 2.4 GHz, and 5.7 GHz bands.

This diode features low forward voltage and high reverse voltage, enabling a wide dynamic range and high efficiency in WPT rectifier circuits.

This diode enables a compact mounting area with its small DFN package.

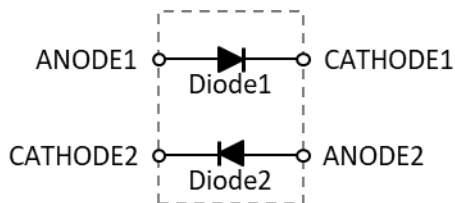


DFN1212-4-HD
1.2 x 1.2 x 0.427 (mm)

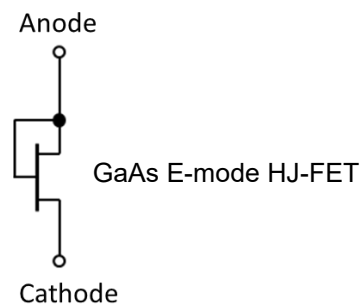
APPLICATIONS

- Rectifier circuits for microwave wireless power transfer systems
- Detector

BLOCK DIAGRAM



< Gated Anode Diode >



■ PRODUCT NAME INFORMATION

NT9002 HD A E4 S

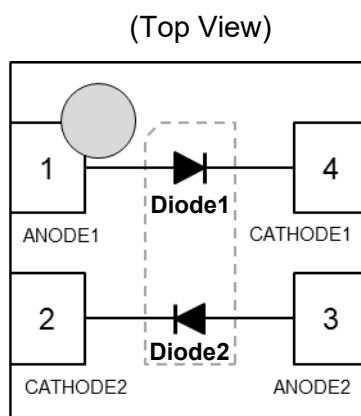
Description of configuration

Composition	Item	Description
HD	Package code	Indicates the package. Refer to the order information.
A	Version	Indicates the product version. "A" is initial version.
E4	Packing	Refer to the packing specifications.
S	Grade	Indicates the quality grade. "S" means general-purpose and consumer application. Operating temperature range: -40°C to +85°C, Test temperature: +25°C

■ ORDER INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	PLATING COMPOSITION	WEIGHT (mg)	QUANTITY (pcs/reel)
NT9002HDAE4S	DFN1212-4-HD	Yes	Yes	SnBi	1.6	3,000

■ PIN DESCRIPTIONS



DFN1212-4-HD Pin configuration

Pin No.	Pin Name	Description
1	ANODE1	Anode terminal (Diode1)
2	CATHODE2	Cathode terminal (Diode2)
3	ANODE2	Anode terminal (Diode2)
4	CATHODE1	Cathode terminal (Diode1)
Exposed PAD		Connecting to the ground plane is recommended.

■ ABSOLUTE MAXIMUM RATINGS

	Symbol	Ratings	Unit
Reverse voltage	V_R	20	V
Forward current	I_F	10	mA
Power dissipation	P_D *1	920	mW
Junction temperature	T_J	+150	°C
Storage temperature	T_{stg}	-55 ~ +150	°C

*1 4-layer FR4 PCB with through-hole (101.5 x 114.5 mm), $T_J = 150\text{ °C}$

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.

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.

■ THERMAL CHARACTERISTICS

Parameter	Measurement Result
Thermal Resistance (θ_{ja})	$\theta_{ja} = 135.3\text{ °C/W}$

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

■ ELECTROSTATIC DISCHARGE RATINGS

	Conditions	Pin No.	Pin Name	Protection Voltage	
				CATHODE1	CATHODE2
HBM	C = 100 pF, R = 1.5 kΩ	1	ANODE1	±60 V	-
		2	CATHODE2	-	COM.
		3	ANODE2	-	±60 V
		4	CATHODE1	COM.	-

	Conditions	Protection Voltage
CDM	Field Induced CDM	±1000 V

ELECTROSTATIC DISCHARGE RATINGS

The electrostatic discharge test is done based on JESD47.
In the HBM method, ESD is applied using the power supply pin and Cathode terminal as reference pins.

When handling devices, devices may encounter electrostatic failure due to a static electricity discharge from the charged operator or equipment. Pay attention during handling.

■ RECOMMENDED OPERATING CONDITIONS

	Symbol	Value	Unit
Operating temperature	T_a	-40 to +85	°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 (DC)

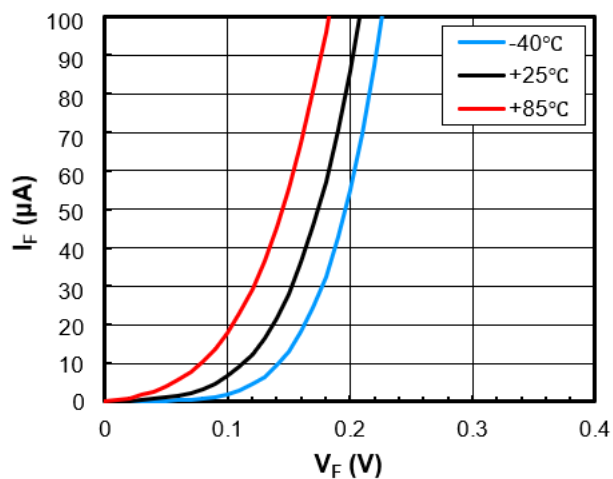
General conditions: $T_a = +25\text{ °C}$

Parameter	Symbol	Test Condition	MIN.	TYP.	MAX.	UNIT
Reverse leakage current	I_R	$V_R = 2\text{ V}$	-	0.5	-	μA
Forward voltage	V_F	$I_F = 2\text{ }\mu\text{A}$	-	0.1	-	V
Forward voltage difference	ΔV_F	Diode1 V_F – Diode 2 V_F	-0.05	-	0.05	V
Series resistance	R_S	$V_F = 0.85 \pm 0.01\text{ V}$	-	110	-	ohm
Total capacitance	C_T	$V_R = 2\text{ V}$, $f = 100\text{ MHz}$	-	0.025	-	pF

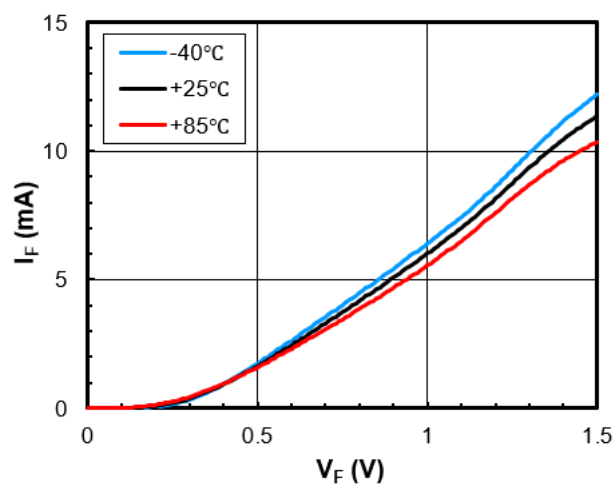
■ TYPICAL CHARACTERISTICS

(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

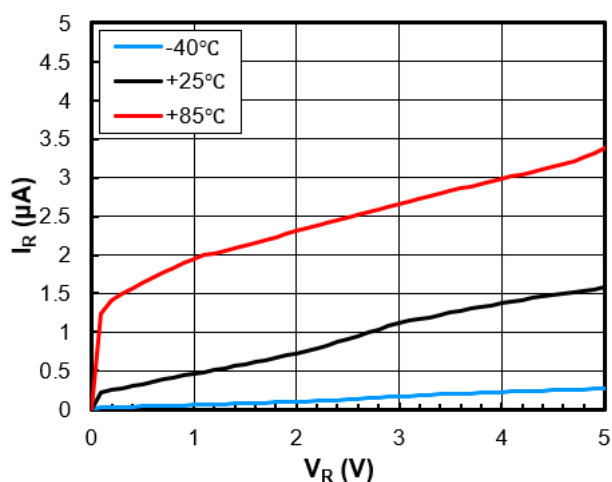
NT9002 Forward Characteristics



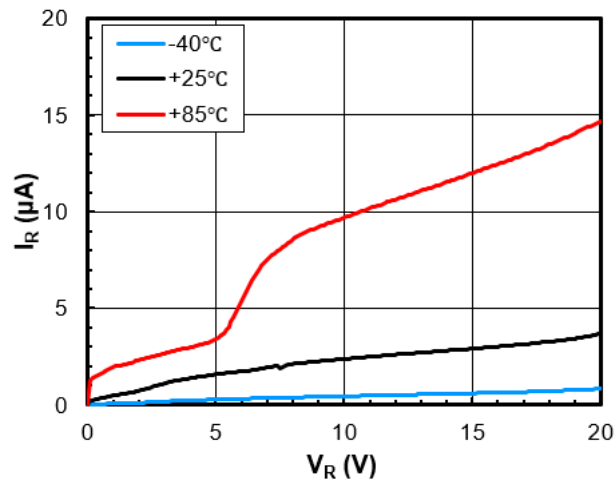
NT9002 Forward Characteristics



NT9002 Reverse Characteristics

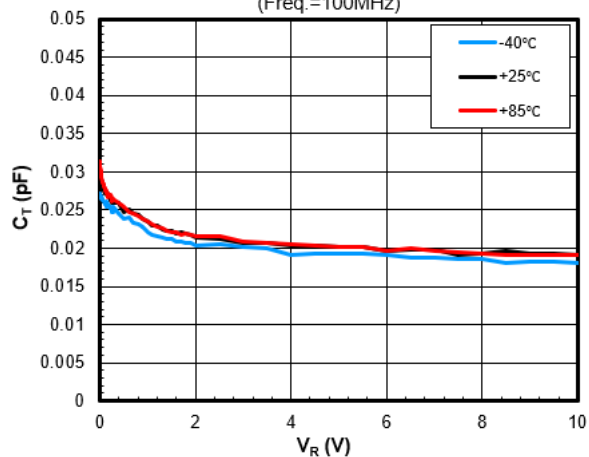


NT9002 Reverse Characteristics

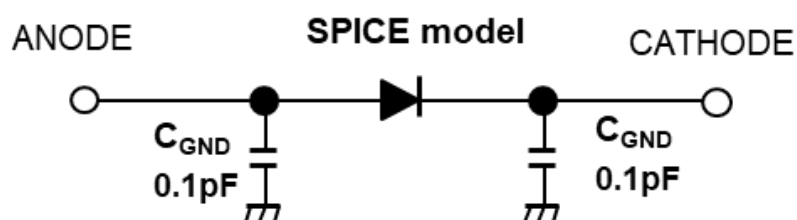


NT9002 Total Capacitance

(Freq. = 100MHz)



■ SPICE MODEL



NT9002HDAE4S Diode model

<SPICE model Parameter>

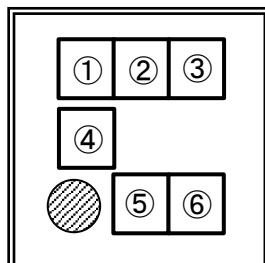
Parameter	Value	Unit
Is	0.26	μA
Rs	106	Ω
N	1.55	-
Cd	0.018	pF
Cj0	0.011	pF
Vj	0.34	V

● Notes on Using the SPICE Model

It requires a capacitor $C_{GND} = 0.1 \text{ pF}$ between each of the external anode and cathode terminals and ground (GND) to improve the simulation accuracy when using the SPICE model.

■ MARKING SPECIFICATION

- ①, ②, ③: Product code
 ④, ⑤, ⑥: Lot number ... Alphabetic Serial number



DFN1212-4-HD Marking Specification

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.

DFN1212-4-HD Marking List

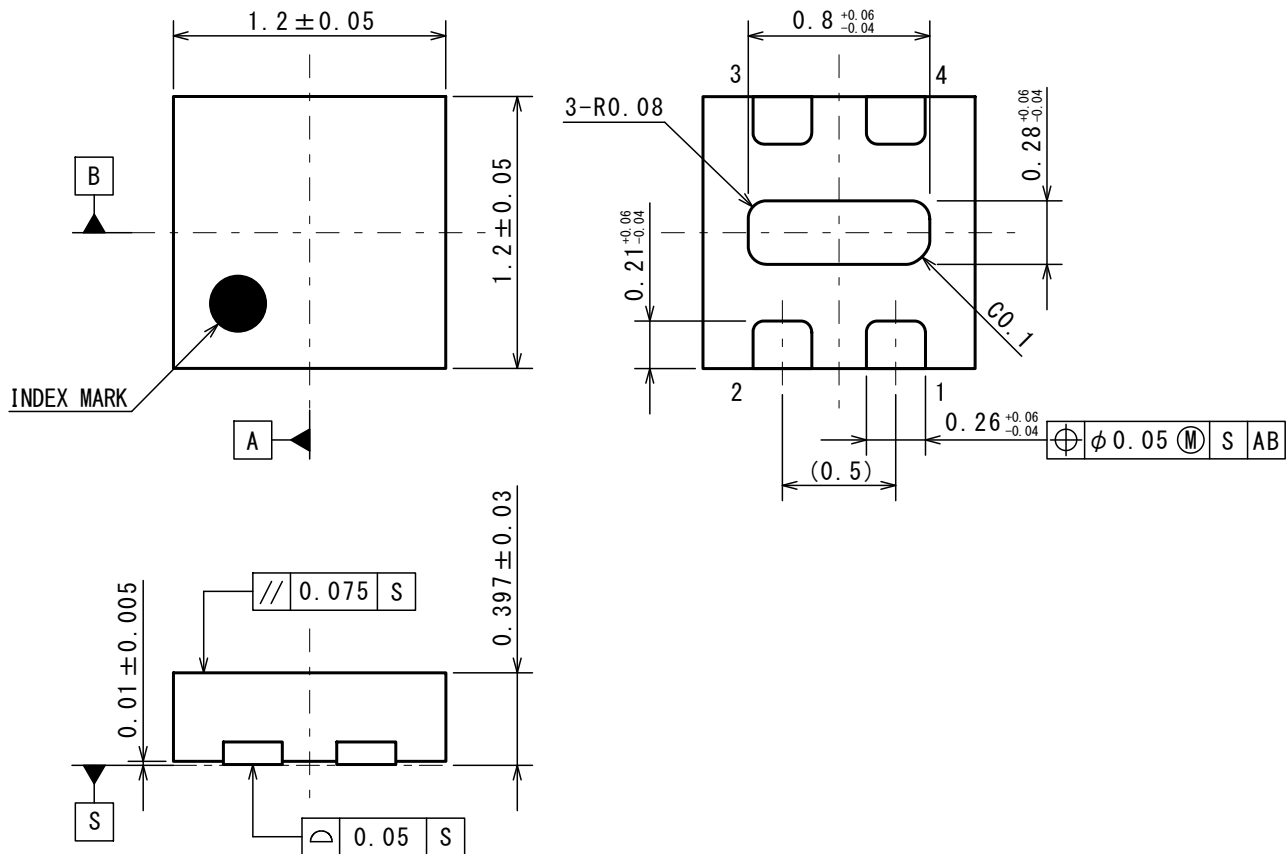
Product Name	① to ③
NT9002HDAE4S	0 0 4

■ Revision History

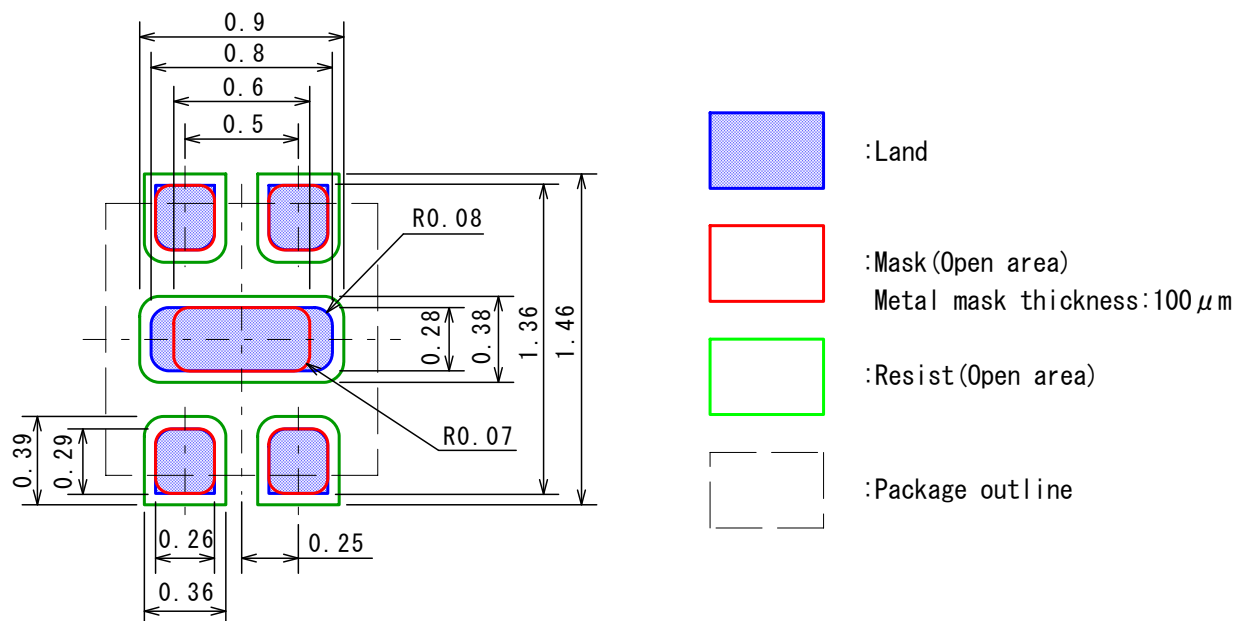
Date	Revision	Changes
March 10, 2026	Ver. 1.1	Revised FEATURES Revised GENERAL DESCRIPTION
February 20, 2026	Ver. 1.0	Initial release

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



Nisshinbo Micro Devices Inc.

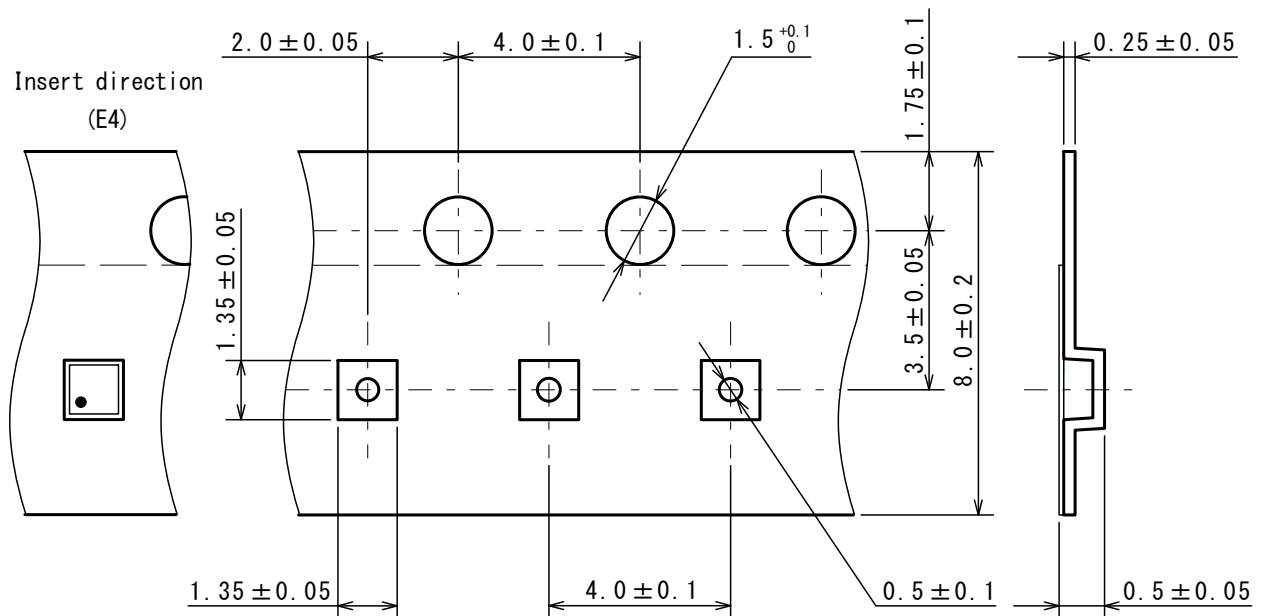
DFN1212-4-HD

PI-DFN1212-4-HD-E-A

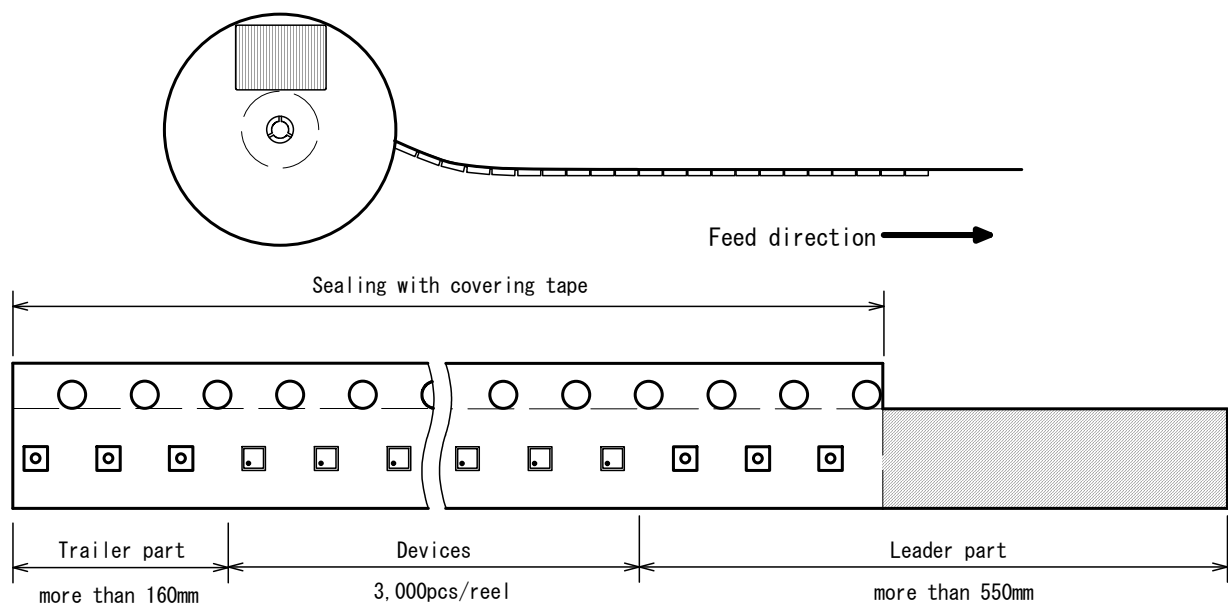
■ PACKING SPEC

UNIT: mm

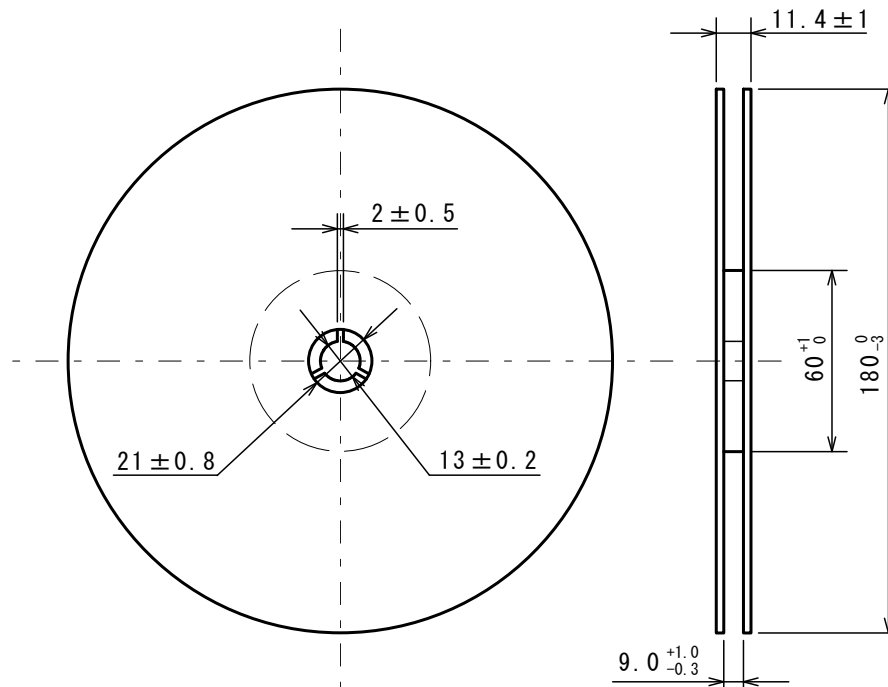
(1) Taping dimensions / Insert direction



(2) Taping state



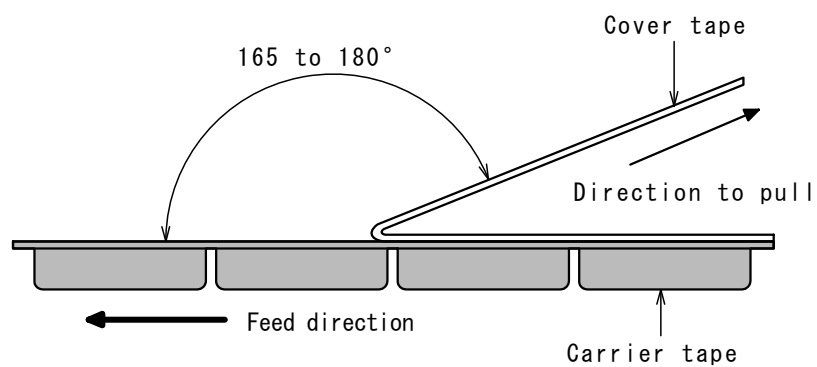
(3) Reel dimensions



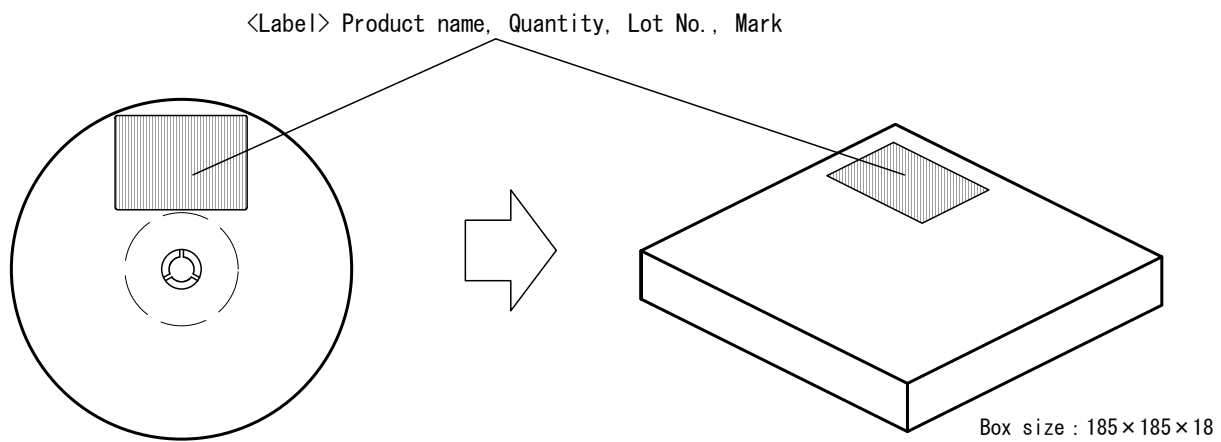
(4) Peeling strength

Peeling strength of cover tape

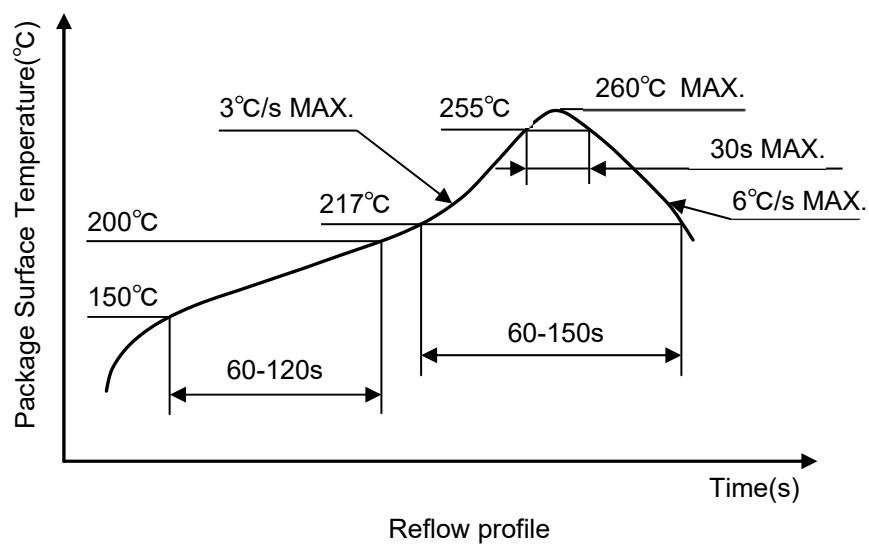
- Peeling angle 165 to 180° degrees to the taped surface.
- Peeling speed 300mm/min
- Peeling strength 0.1 to 1.0N



(5) Packing state



■ HEAT-RESISTANCE PROFILES



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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.
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 - Aerospace Equipment
 - Equipment Used in the Deep Sea
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 - 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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