# Bare Die Products
# Handling and Operating Manual

This manual describes notes on using Epson Wafer products. It is the responsibility of the customer to optimize the process and the mounting parameters to obtain the optimum results.
The content of this document is subject to change without notice.

# Bare Die Products Handling and Operating Manual

Notice using this document

This document is not intended to define “specifications” or “recommendations” but to introduce something to note while using the product.

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## 1. Outline of Wafer and Bare Die Products

Wafer products and Bare Die products are shipped as wafers or diced (singulated) dies according to the customer's request in order to realize the mounting on the substrate in the bare die stated by the customer.

Wafer products are subjected to the process from our wafer production process's probe inspection process (electrical characteristics test) and are shipped to customers in wafer state (after back grinding or no back grinding).

Bare die products which shipped in die state are subjected to back grinding, dicing, placing in the tray and visual inspection.

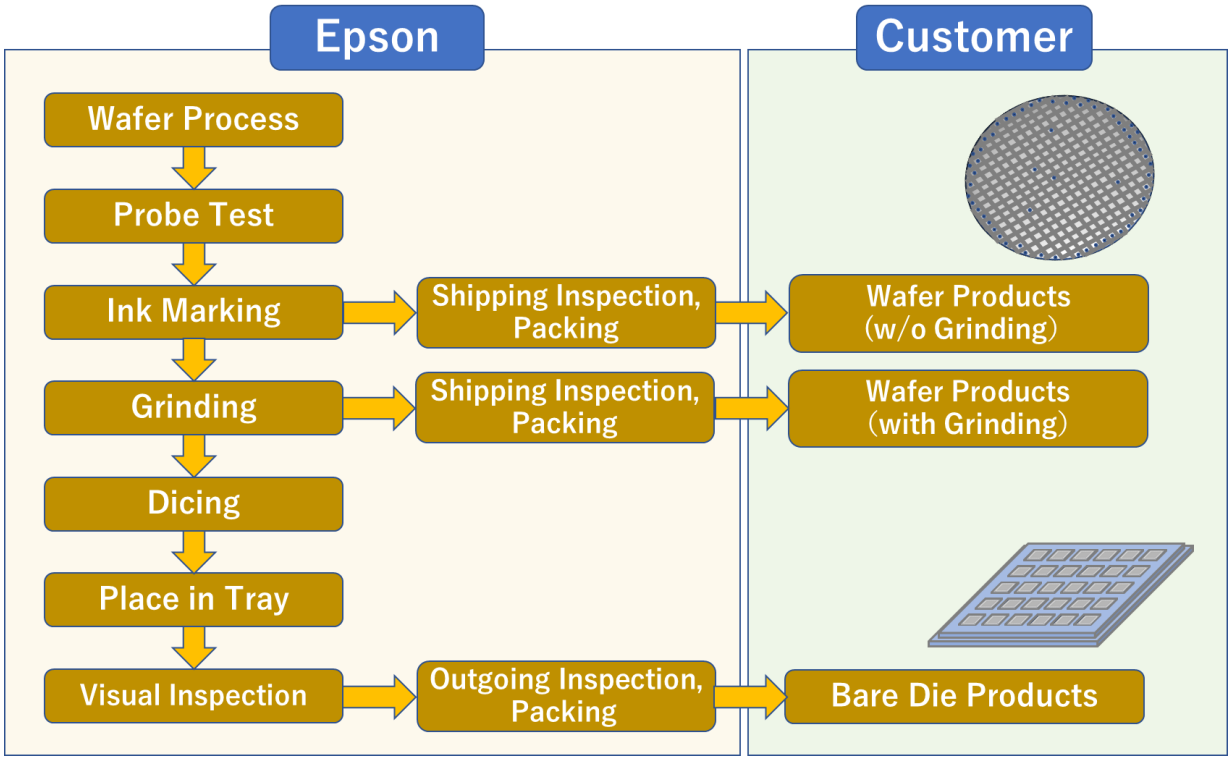



Fig. 1.1 Sample Flow: Wafer･Bare Die Products.

Wafer products and bare die products are stored and shipped in shipping containers as shown.

Fig. 1.2
Wafer Shipping Box
(Wafer Vertical Type)

Fig. 1.3
Wafer Canister
(Wafer Horizontal Type)

Fig. 1.4
Die Tray

## 1.1 Bare Die Structure

An example of a general structure of our bare die is shown as follows.

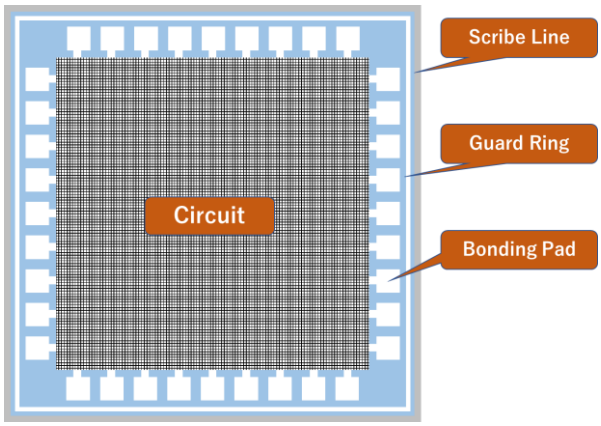



Fig.1.5 Example Bare Die Structure

Table 1.1 Die Structure and Feature Description

| Each Parts Name | Function Description |
|---|---|
| Scribe Line | Cutting area for dicing from the wafer. |
| Guard Ring | Arranged for the improving the moisture resistance from the bare die cross section direction (each interlayer). (Depends on the device. Prepare as needed.) |
| Bonding Pad | Terminals to connect to external circuit. |
| Circuit | Electrical circuit area. |
| Passivation | Passivation applied on wafer and bare die products surface are not design to protect the die from external impact. |

## 1.2 Examples of Structure by Pad Type

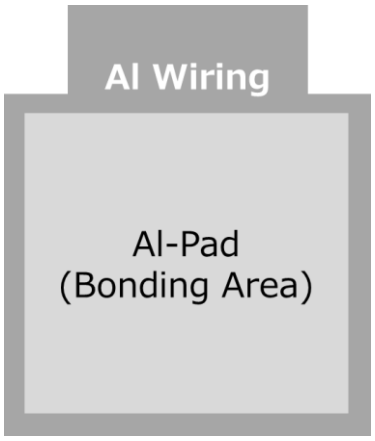



Fig. 1.6 Al-Pad
(Top View)

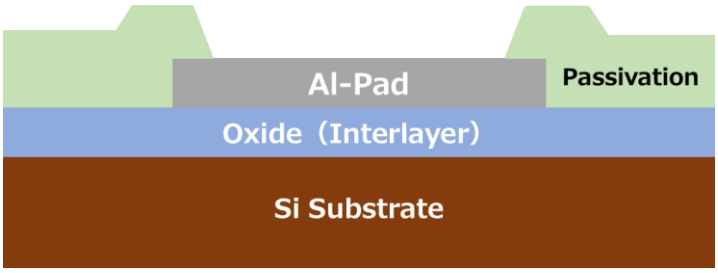



Fig 1.7 Al-Pad
(Section View)

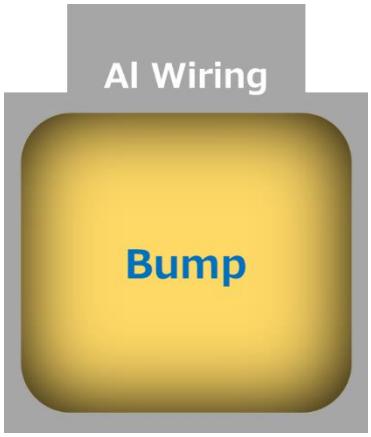



Fig. 1.8 Au-Bump
(Top View)

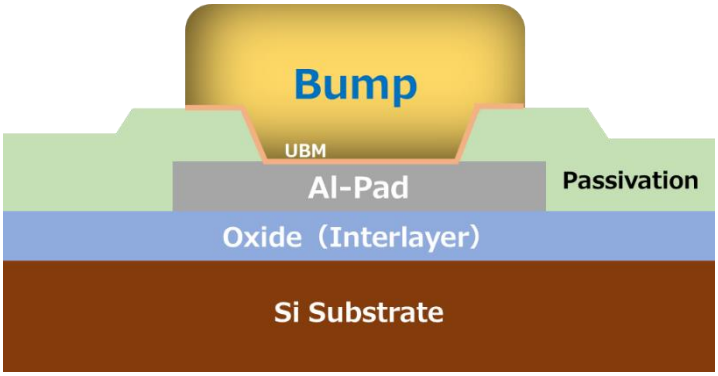
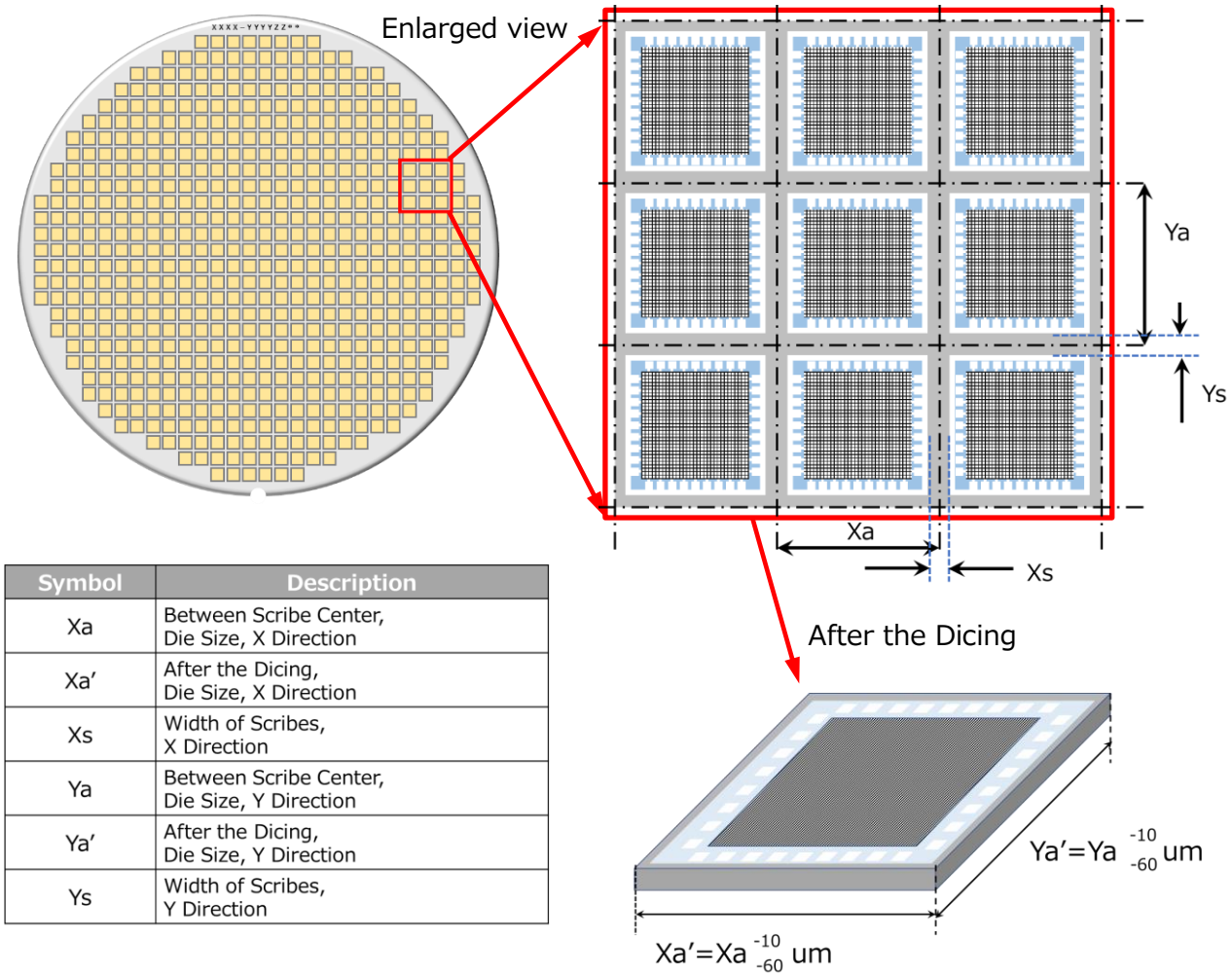



Fig. 1.9 Au-Bump
(Section View)

## 1.3 Die Size and Tolerance of Bare Die Products

The die size that described in our product development specifications is the width between scribe centers. The bare die products are cut in the scribe area by using a dicing blade, so the die size of the bare die products is smaller than the width between scribe centers. The die size and tolerance of the bare die products after the dicing are shown as follows.




| Symbol | Description |
|---|---|
| Xa | Between Scribe Center, Die Size, X Direction |
| Xa' | After the Dicing, Die Size, X Direction |
| Xs | Width of Scribes, X Direction |
| Ya | Between Scribe Center, Die Size, Y Direction |
| Ya' | After the Dicing, Die Size, Y Direction |
| Ys | Width of Scribes, Y Direction |

Fig. 1.10 Example of Die Size

## 2. Handling Precaution for Wafer and Bare Die products

### 2.1 Introduction

Our semiconductor products are designed and manufactured to assure problem-free operation when used under normal operating conditions. All products are subject to stringent electrical and mechanical testing to ensure reliability, but users are strongly recommended to observe the following precautions when designing systems, handling and storing products to minimize the chance of failure.

- Wafer and Bare Die products have a higher risk of quality and reliability degrading depending on the handling method than general products.
- The passivation film applied on wafer and bare die products surface are not design to protect the die from external impact.
- Moisture and dust in the air and careless handling during assembly can cause defective products, so please take care adequately.
- Please perform sufficient evaluations for quality and reliability by the customer: such as testing and screening to detect failures.

### 2.2 Storage

- Do not induce impact, vibration, or contact with water to prevent damages of bare die.
- Do not store or use the products under conditions where moisture condensation may be formed due to rapid changes in temperature. Also, do not put on load to the product during storage
- When storing, avoid dusty conditions or locations with corrosive gases.

### 2.2.1 Storage Periods of Bare Die Products

● When bare dies are shipped, they are put in dedicated trays, and the trays are clipped together so that dies are properly held in the trays during transportation. Then the trays are packed in antistatic bags. Do not open the bags more frequent than necessary to prevent foreign contamination to the dies. Also, do not leave trays open for prolonged time.

Table 2.1 Storage Periods of the Bare Die Products

| Status | Storage Periods | Storage Conditions |
|---|---|---|
| Before Opening | 6 months | Ta≦35℃、RH≦80% |
| After Opening | 30 days | Ta≦30℃、RH≦80% |
| | 6 months | Dew Point -30℃ or less in Dry $N_2$ |

(Maximum allowable storage periods, including before and after opening the packing, are twelve months under the conditions mentioned.)

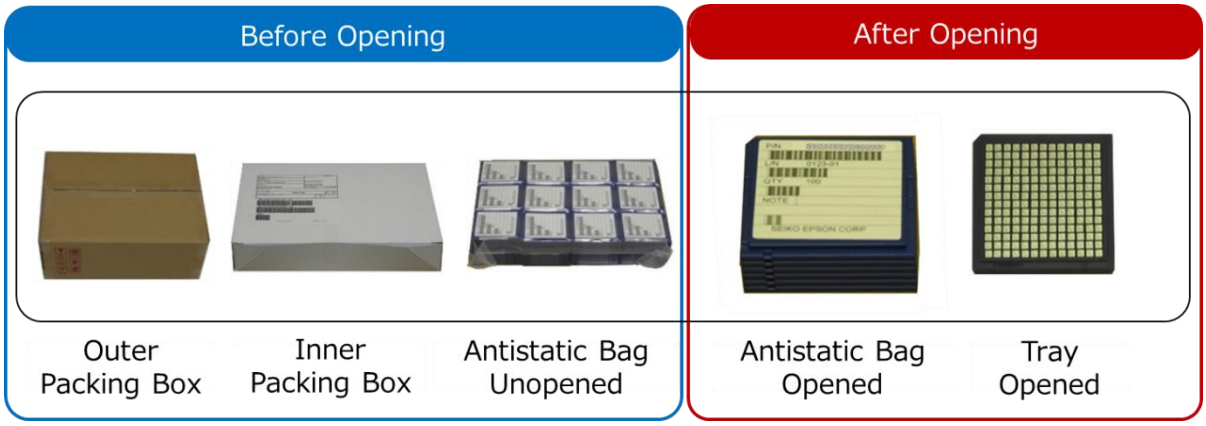



Fig.2.1 Example of Opening the Packing (Before and After Opening) of Bare Die Products

● After the bags are opened, assemble the products immediately in order to prevent the bonding degradation caused by the quality change on the bonding pad surfaces.

● If products are to store for long period of time, sufficient mounting evaluations (e.g. bondability evaluation) by the customer is needed.

## 2.3 Precautions for Bare Die Products handling

● Open, store, process, and mount bare die products in a clean environment where the die surface is not be exposed to contaminated atmospheres or substances. Examples of recommended environment conditions are shown as follows.

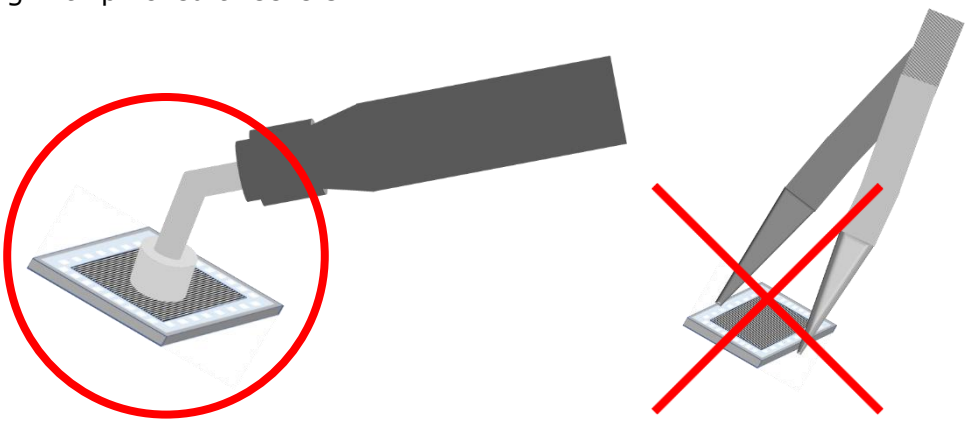
In case of storing after the opening packing ~ISO 6

In case of processing / mounting ~ISO 8

Table 2.2 ISO14644-1 Cleanroom Classifications

| Fed.std.209E | Maximum Particles/ft$^3$ | | | | | JIS B9920 ISO 14644-1 |
|---|---|---|---|---|---|---|
| | 0.1μm | 0.2μm | 0.3μm | 0.5μm | 5μm | |
| Class 1 | 35 | 7.5 | 3 | 1 | - | ISO 3 |
| Class 10 | 350 | 75 | 30 | 10 | - | ISO 4 |
| Class 100 | 3,500 | 750 | 300 | 100 | - | ISO 5 |
| Class 1,000 | 35,000 | 7,500 | 3,000 | 1,000 | 7 | ISO 6 |
| Class 10,000 | - | - | - | 10,000 | 70 | ISO 7 |
| Class 100,000 | - | - | - | 100,000 | 700 | ISO 8 |

● When handling bare die products manually, use a suction type of bare die collet (e.g. vacuum tweezers) to avoid contamination or scratches on the bare die surface instead of handling with pinched tweezers.



Recommended Handling Not-Recommended Handling

Fig. 2.2 Example of Manually Handling of Bare Die Products

## 2.4 Precautions for Mounting Bare Die

- When mounting bare die, perform in a clean environment where it is not exposed to contaminated atmospheres or substances.
- Please use the bare die collet for pickup and die bonding. If foreign material adheres to the collet, process defects such as scratches on the bare die surface may occur. When using a collet with a surface that comes into contact with the bare die surface, periodic cleaning should be carried out.
- Do not clean bare dies. If bare dies have to be cleaned, extreme precaution must be carried out to ensure no residue remain on die surface.
- When mounting bare die, take sufficient countermeasures against static electricity.
- For sealing resins, use “semiconductor grade” products. This is recommended to prevent corrosion in bonding pads due to moisture absorption, and reduce internal stress due to temperature changes. Similar precautions must be taken for other materials to be used.

## 2.5 Precautions Against the Light Irradiation

Exposing semiconductor products to the light may cause malfunction, as the light affects the device characteristics. To prevent products from malfunction, please take into account the following points regarding semiconductor mounted substrates and products.

- During product design and assembly, please consider the product structure so that the bare die is shielded from light in actual use.
- In the testing process, please provide the light-shielded environment for the bare die under test.
- Please consider shielding light from the surface, back, and sides of the bare die, as bare die should be shielded from light entirely.

## 3. Countermeasures Against Static Electricity in Handling Semiconductor Products

Although all terminals are equipped with an anti-electrostatic circuit, exceeding the electrostatic capacity may cause malfunction. So please take sufficient countermeasures when handling products.

This document introduces examples of basic countermeasures. Please refer to below guidelines.

### 3.1 Working Environment

- It is recommended that the working environment be maintained at a relative humidity of at least 45%. If the relative humidity is low, the charge diffusivity decreases, and it becomes easier to charge up.
- Lay a conductive layer (conductive mat / conductive sheet) on the floor and connect it with ground potential. Also, always keep the surface clean as contamination on the surface of the conductive layer will degrade its conductivity.
  -e.g. "Conductive floor surface resistance" to "between surface and Ground": 1MΩ to 1000MΩ
- Ensure that the workbench has a conductive mat to remove static electricity and connect it with ground potential. Do not use a metal workbench because it can cause a rapid electrostatic discharge.
  -e.g. "Workbench conductive mat etc. surface resistance"
  to "between surface and Ground": 1MΩ to 1000MΩ
- Cover the work chair with a conductive cover and ground it to a conductive floor with a grounding chain.

### 3.2 Storage Environment

- Containers and bags used for transporting and storing semiconductor products should be made of materials that dissipate static electricity.
  -e.g. Surface resistance value of static dissipative material: $1\times10^{5}\Omega$ to $1\times10^{11}\Omega$
- Lay the storage shelf with a conductive mat on the surface and connect it with ground potential. Dust on the surface of the conductive mat etc. will reduce the conductivity, so always keep the surface clean.
  -e.g. "Worktable conductive mat etc.'s surface resistance"
  to "resistance between surface and Ground": 1MΩ to 1000MΩ
- Use a conductive mat on the cart carrier and ground it to the conductive floor using a grounding chain or conductive caster.

### 3.3 Handling

- Persons who handle the products should be connected to ground potential by a wrist strap, antistatic clothing, conductive shoes, etc.
  - -Place a high resistance resistor (e.g., one meg ohm) in the wrist strap to prevent electric shock to human body.
  - -e.g. Resistance of Antistatic clothing + conductive shoes: 1MΩ to 100MΩ

### 3.4 Equipment and Jig

- In order to prevent accumulation and induction of static electricity, connect the manufacturing equipment, inspection and test equipment, conveyors and other transport mechanisms, and tools with ground potential.

## Appendix- 1 Opening Procedure for Bare Die Products (ABS Tray)

**Packing style upon arrival**

・Cut the tape on the top of the cardboard box and open

**Cardboard box opening**

・Remove top cushioning cardboards.

**After removing the packing**

・Take out the inner box.
Capacity : Max 4 inner packing boxes

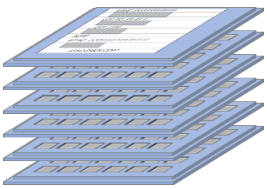
・Opening inner packing boxes.
Capacity(3 inch) : Max 2×3×2 = 12 blocks
Capacity(2 inch) : Max 3×4×2 = 24 blocks

**Take out die tray blocks**

・Open antistatic bag and take out die tray box.

・Remove film band from die tray blocks.
Capacity: Max 5 tray + lid

**Die tray opening**



**Regarding " non-clean room environment" and "In clean room environment", Refer to Table 2.1 Storage Periods of Bare Die Products.

non-clean room environment

In clean room environment

## Appendix-2 Opening Procedure for Bare Die Products (PS Tray)

**Packing style upon arrival**

・Cut the tape on the top of the cardboard box and open

**Cardboard box opening**

・Remove top cushioning cardboards.

**After removing the packing**

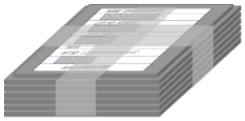
・Take out the inner box.
Capacity : Max 4 inner packing boxes.

・Opening inner packing boxes.
Capacity(3 inch) : Max 2×3×2 = 12 blocks
Capacity(2 inch) : Max 3×4×2 = 24 blocks

**Take out die tray blocks**

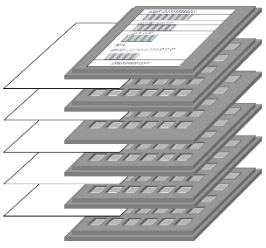
・Open antistatic bag and take out die tray box.

・Remove film band from die tray blocks.
Capacity: Max 5 tray + lid



**Die tray opening**

・Remove interleave paper between



**Regarding " non-clean room environment" and "In clean room environment", Refer to Table 2.1 Storage Periods of Bare Die Products.

non-clean room environment

In clean room environment

# Revision history

| Rev. No | Date | Page | Type | Revision contents (including old contents) And reason for revision |
|---|---|---|---|---|
| Rev.1.0 | 2020/01/16 | All | New | New regulations |
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