Reconstructed wafer specifications for visual inspection and packing

Introduction

The purpose of this technical note is to define the visual defect criteria that should be applied during wafer reconstruction of STMicroelectronics' Imaging products.

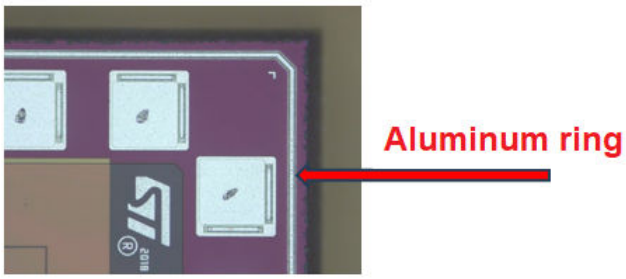
Wafer reconstruction is a process that involves several steps. During these different steps, several visual inspections are made by subcontractors of the Imaging division. The visual inspections are made by "sampling", or by "automated visual inspection (AVI)". The AVI method requires that 100% of units are tested. All visual inspections are performed in a controlled clean room, and correspond to either class 10 or class 100.

Note that the wafer reconstruction process impacts the packing information of the above products.

1 100% automated visual inspection

The die area is delimited within an aluminum delimiting ring (see Figure 1. Aluminum ring delimiting the die area). The sawing specifications are defined based on this aluminum ring delimitation.

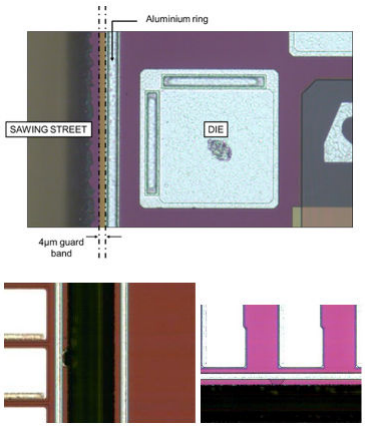
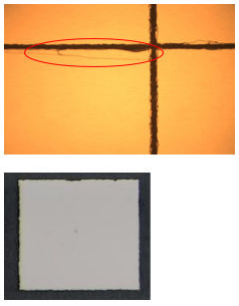
Figure 1. Aluminum ring delimiting the die area

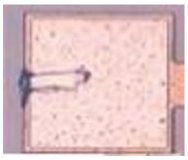
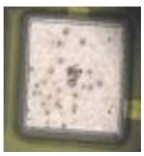
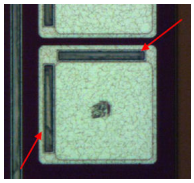
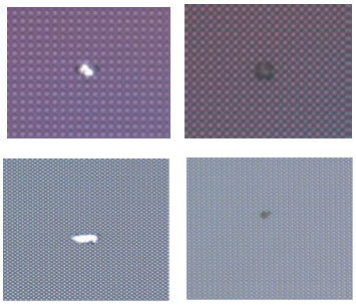
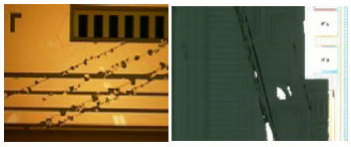
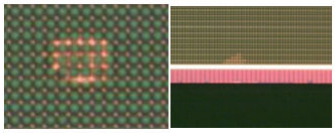
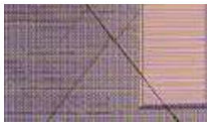


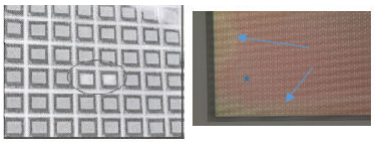
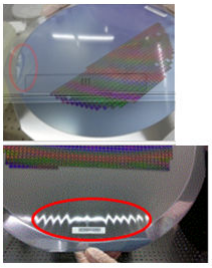
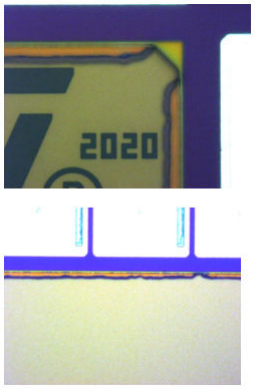
An AVI is made by a machine after the wafer is reconstructed. The method is applied to 100% of the dice. If an observed part shows any value that is over the threshold defined for the product, the inspected wafer is held for analysis and investigation. Consequently, each defect that is detected by the AVI is manually reviewed by an operator who checks whether the wafer is accepted or rejected.

Table 1. AVI rejection criteria provides the criteria used to reject a wafer. Note that if a new defect is observed, a treatment must be defined for it. Then, Table 1. AVI rejection criteria must be updated.

Table 1. AVI rejection criteria

Item	Rejection criteria	Illustrative photo (1)
Topside chipping	Reject chipping that penetrates within the 4 µm guard band from the outer ring	
Backside chipping	• Reject chipping with a depth (Z) ≦75 µm • Reject chipping with a width (Y) ≦30 µm *Note: Chipping in the X direction is not considered critical.*	

Item	Rejection criteria	Illustrative photo (1)
Silicon chips	Reject visible silicon chips that are stuck on the surface of the wafer: • For the nonsensor area, reject chips with an area > 100 µm^2, and a length >10 µm. • For the sensor area, reject chips that are 1 pixel in size.	
Pad	• Reject smeared probe marks that cause lifted passivation, or expose any metallization. • Reject misaligned probe marks on the pad area. • Reject marks in the passivation that extend through the underlying pad metal, or beyond the passivation overlap. • Reject any contaminated or discolored areas that cover more than 1/16 of the pad area.	  
	Exception: DO NOT reject resin residues in the trench pad. This is a known cosmetic defect.	
Foreign materials	Reject unremovable foreign materials, such as organic products, glue, stains, and particles. • For the nonsensor area, reject foreign materials that have an area >100 µm^2, and a length >10 µm. • For the sensor area, reject foreign materials that are 1 pixel in size.	
Scratches	• For the nonsensor area, reject scratches that have an area >100 µm^2, and a length >10 µm. • For the sensor area, reject scratches that are 1 pixel in size.	
Wafer related	Reject all visible wafers related to defects such as abnormal color, peeling, or contamination. Also, reject any metal layer exposure. • For the nonsensor area, reject wafers with a defect area >100 µm^2, and a defect length >10 µm. • For the sensor area, reject wafers with defects that are 1 pixel in size.	
Die cracks	Reject chips, cracks, and any other large-scale defects.	

Item	Rejection criteria	Illustrative photo (1)
Physical aspect	Reject all discolored dice.	
Tape	Reject abnormal tape.	
Underlayer cosmetic defect	The underlayer makes irregular edge patterns. ***DO NOT reject. This is a known cosmetic defect.***	

1. *These photos may not represent the current process.*

2 Reconstructed wafer traceability and emap bin format

There is full traceability between the reconstructed wafer and the initial fab wafer. The VI rejects are not removed from the reconstructed wafer, so STMicroelectronics can provide an emap of the reconstructed wafer at the same time as the parts. This ensures that the customer avoids assembling any VI rejected parts, as shown in Figure 2. Emap below.

Note: Traceability at STMicroelectronics is secure because there is no lot mixing.

Figure 2. Emap

3 Packing specifications

The reconstructed wafer process impacts the packing information of STMicroelectronics' Imaging products. The reconstructed wafers are made of dice on a UV shipping tape, set on a metal wafer ring.

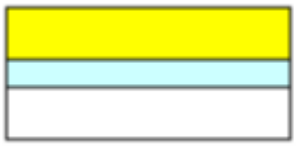
3.1 Packing material

Table 2. Packing material

Reconstructed wafer size	Item	Specification	Marker
8 inch (8")	Shipping tape	D-175	Lintec
	Iron frame	Compact disco 8" reconstructed size	FH
	Cassette	Size: For 8" reconstructed wafer Color: Black (anti-ESD) Material: polypropylene (PP)	BIEMT

3.2 Shipping tape structure

Figure 3. Shipping tape structure



3.3 Shipping tape specification

Table 3. Shipping tape specification

Item		D-175	Comment
Tape thickness (µm)		90	Without release film
Face material (µm)		PVC/80	Material/Thickness
Color		Blue	
Adhesive layer (µm)		Acrylic/10	Material/Thickness
Adhesion (mN/25 mm)	Before UV	3130 (320)	Conforms to JIS Z 0237
	After UV	290 (30)	(): g/25 mm

3.4 Recommendations for UV exposure

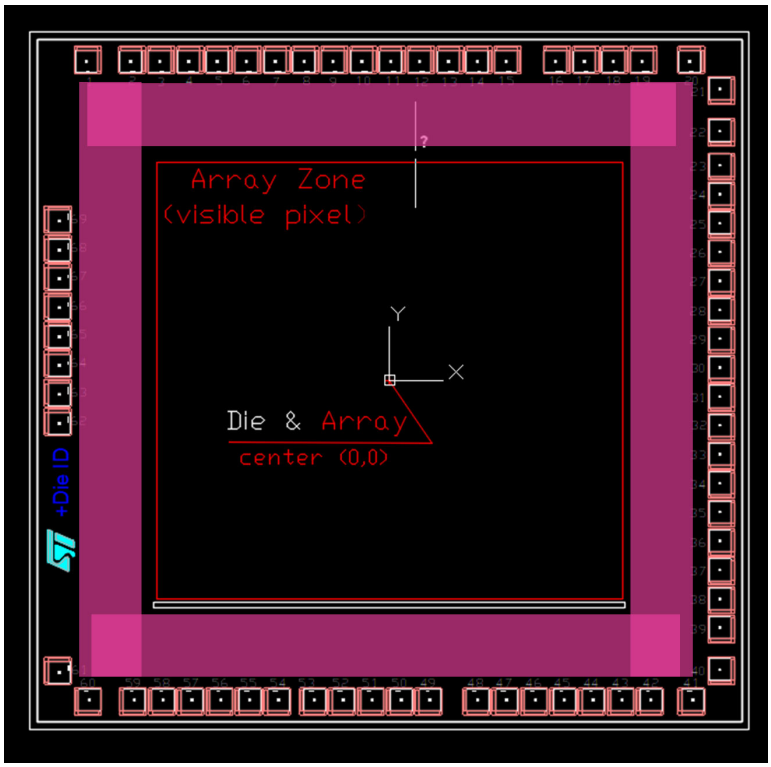
The shipping tape supplier recommendations below are for the parameters that are applied to the UV exposure of the reconstructed frame.

- UV ray intensity: 230 mW/cm^2
- UV ray dosage: 190 mJ/cm^2
- UV wavelength: should be around 365 nm

3.5 Recommendations for the die pick

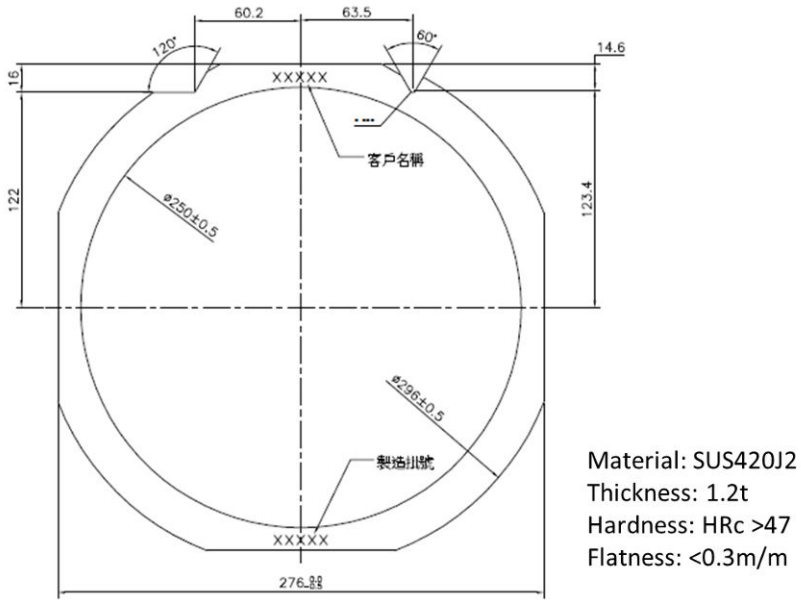
For optical sensors, use a rubber tip/pick tool that is designed so that it cannot touch the optical array of the sensor.

Figure 4. Recommended pick area shown in pink



3.6 Dimensions of the 8" metal wafer ring

Figure 5. Dimensions of the 8" metal wafer ring



3.7 Packing procedure

The frames are packed in plastic containers in a class 10 clean room environment. Each plastic container has a maximum capacity of 25 frames, but it can be filled with a maximum of 13 reconstructed wafer rings. In this way, the reconstructed wafer rings are separated by an empty wafer position.

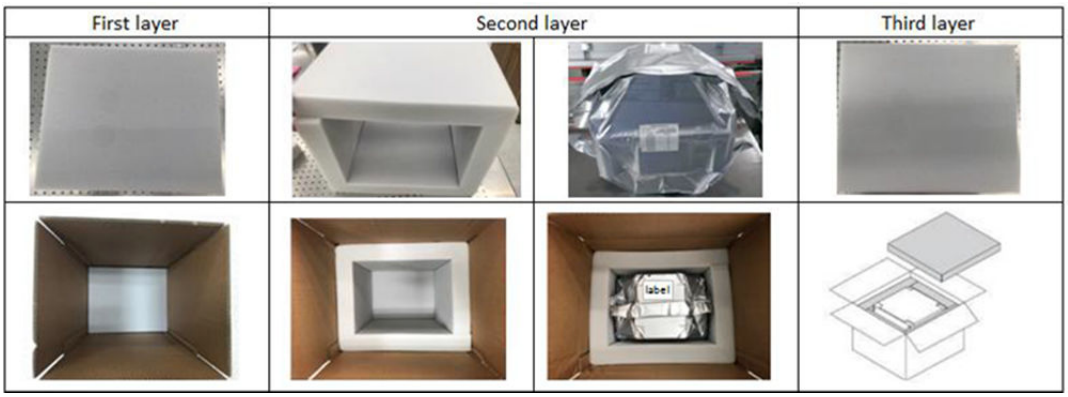
In the class 10 room, plastic containers have their opening taped with an ESD-safe tape (see Figure 6. Frame packing). They are vacuum sealed in a moisture barrier bag. One desiccant and one humidity indicator are included in the bag.

Figure 6. Frame packing

In the class 100 room, plastic containers are placed in a padded carton box. Only one vacuum-sealed plastic container is allowed per carton box.

Two foam pads are placed in the carton box at the top and bottom of the container. This provides protection to all six sides of the plastic containers (see Figure 7. Padded carton box).

Figure 7. Padded carton box



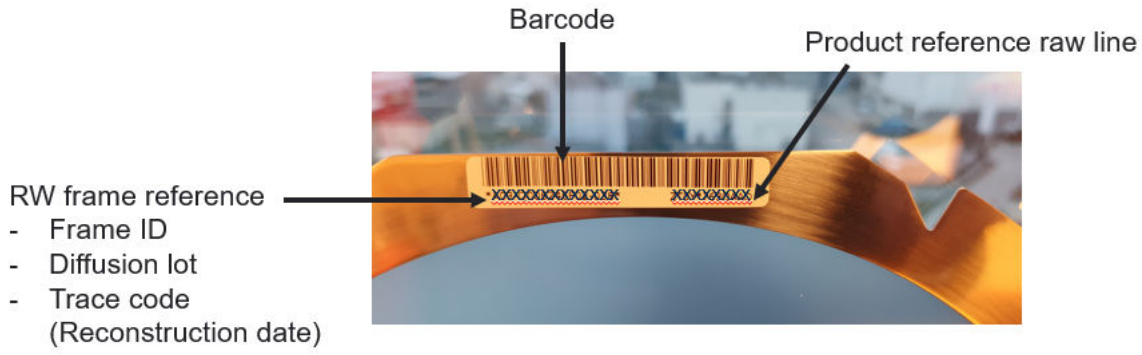
- Box size： 390*325*410 mm
- Box net weight： 1.2 kg
- Frame 13 pcs net weight： 5.15~5.2 kg

Important: A box must only be filled using reconstructed frames made from wafers belonging to one single common diffusion lot. A box must not contain dice coming from several diffusion lots.

3.8 Labels on the reconstructed frame

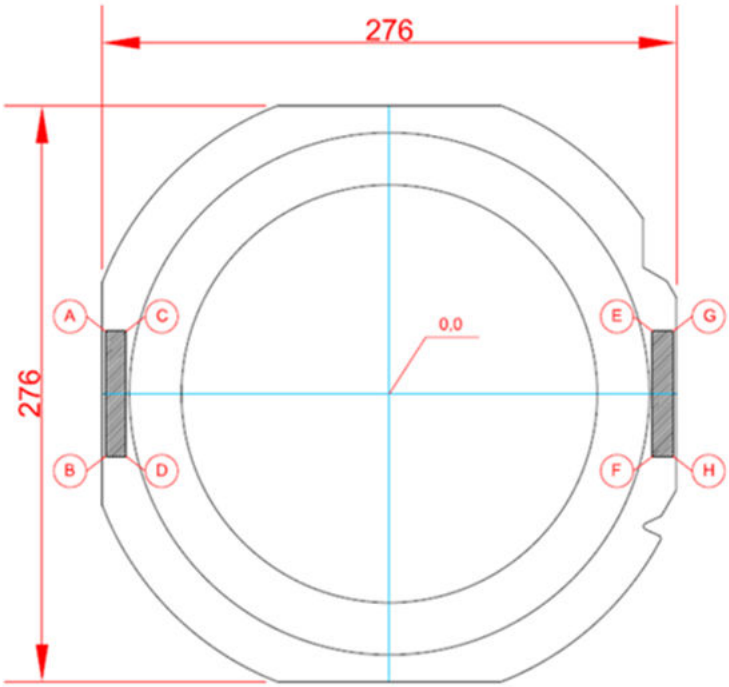
STMicroelectronics uses package labels for shipping its reconstructed wafers. The customers can quickly and easily verify orders, and identify the packaged contents. Two labels are placed on the top and bottom of the reconstructed wafer frame. The label content is shown below.

Figure 8. Label content



The labels are set as shown below.

Figure 9. Label setting



All +/-3	X(mm)	Y (mm)
A	-136.5	30
B	-136.5	-30
C	-126.5	30
D	-126.5	-30
E	126.5	30
F	126.5	-30
G	136.5	30
H	136.5	-30

X and Y values are the distances to the center (0;0) following the respective axes

3.9 Labels on the box

Two types of labels are used and stuck on the carrier box and on the plastic bag. They are called:

- “STMicroelectronics' standard label”
- "Packing list label”

3.9.1 STMicroelectronics' standard label

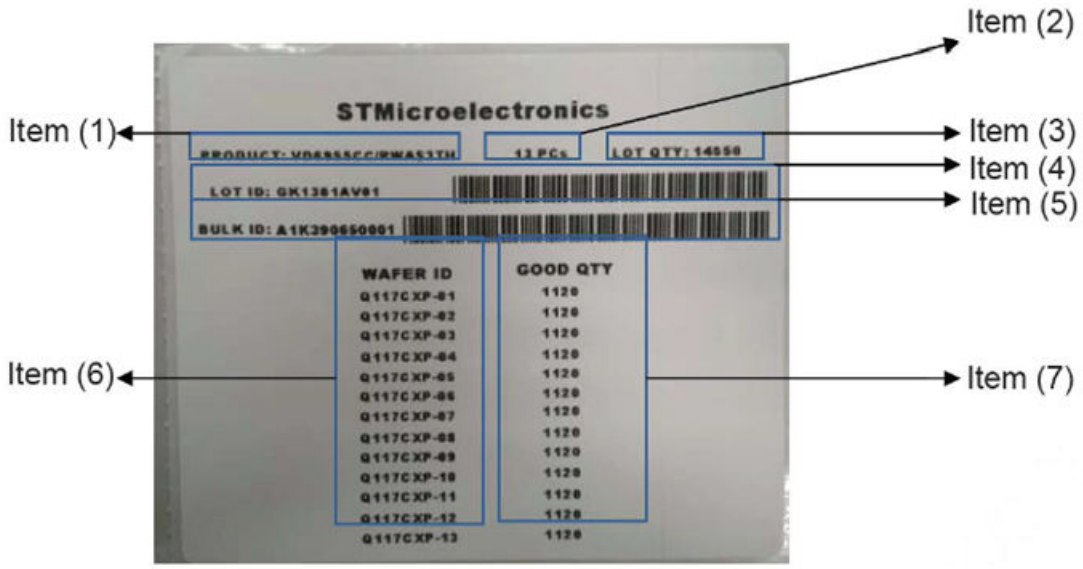
Figure 10. **STMicroelectronics' standard label**

The information on the STMicroelectronics' standard label is as follows:

(1)	Bag seal date	Bag seal date
(2)	Order code	STMicroelectronics' order code
(3)	FG code	STMicroelectronics' finished goods code
(4)	Lot quantity	The total number of good dice in the cassette
(5)	Trace code	STMicroelectronics' back-end plant trace code for product tracing: Y: Year WW: Week LLL: Rolling sequence of 0~9 and A~Z, without the letters I and O.
(6)	Source lot number	STMicroelectronics' source lot number
(7)	Bulk ID	STMicroelectronics' tracking number

3.9.2 Packing list label

Figure 11. **Packing list label**



The information on the packing list label is as follows:

(1)	Product	Product type
(2)	Wafer quantity	Wafer quantity
(3)	Lot quantity	The total number of good dice in the cassette
(4)	Lot ID	Lot number
(5)	Bulk ID	STMicroelectronics' quality number for tracing
(6)	Frame ID	Frame ID number
(7)	Die quantity	The total number of good dice in the frame

3.10 Label position on the box and bag

The standard and packing list labels are placed on the plastic container (shipping box), and on the moisture barrier bag. The labels are placed in the following order:

- Packing list label
- Standard label

Figure 12. Example of label positioning on the box and sealed bag (1)

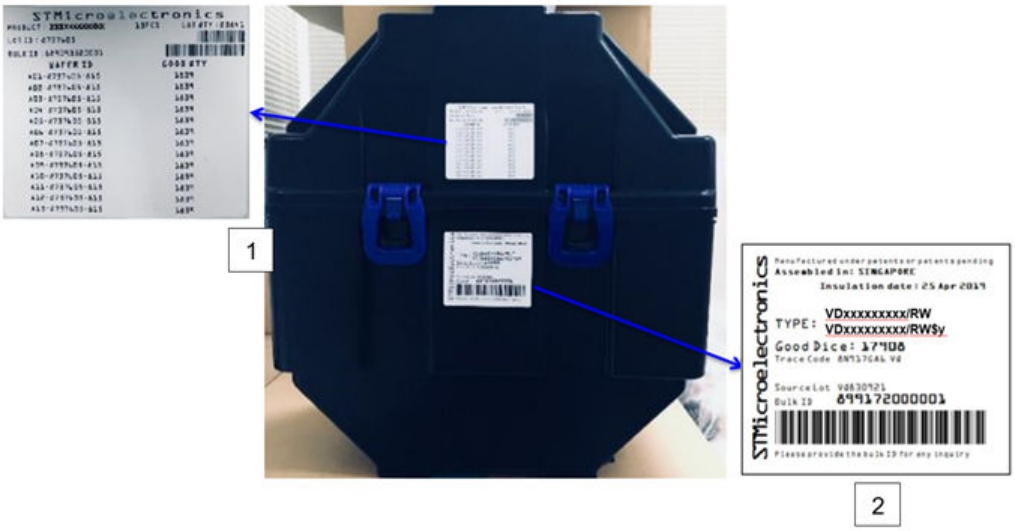
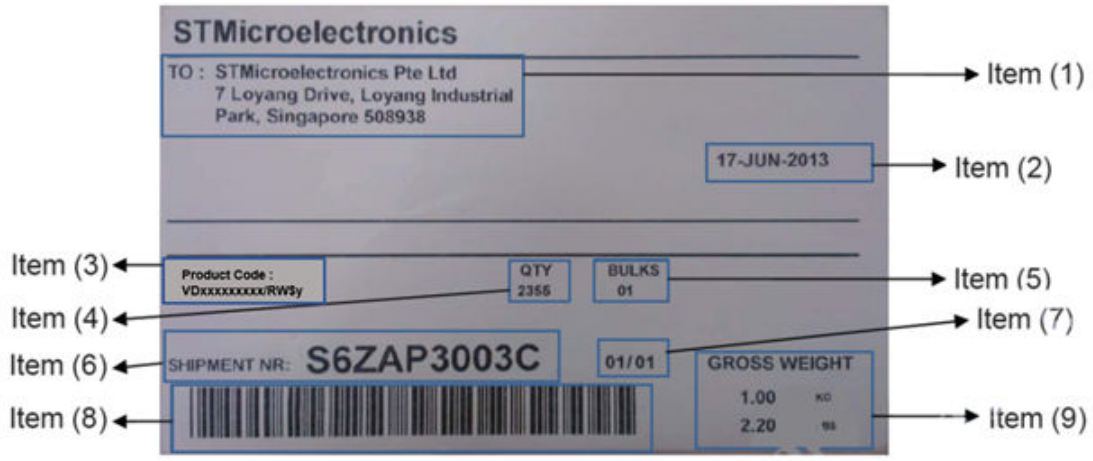


Figure 13. Example of label positioning on the box and sealed bag (2)

3.11 Label on the carton box

An outer label is placed on the carton box. This label displays the information shown in the image and table below.

Figure 14. Carton label example



(1)	Address	Customer address
(2)	Date	Label print date
(3)	Product code	STMicroelectronics' product code
(4)	Quantity	Total number of good dice in the carton
(5)	Bluks	Quantity of inner boxes packed inside the carton
(6)	Shipment NR	S” + destination code + year + rolling sequence. Year: 2020 is year 0, 2021 is year 1, and so on… Rolling sequence: 0~9 and A~Z, without the letters I and O.
(7)	Carton quantity	Total carton quantity
(8)	Barcode	Shipment, carton, and checking number
(9)	Gross weight	Gross weight (kg and pounds)

3.11.1 Position of the label on the carton box

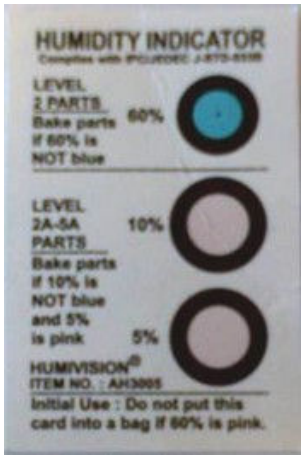
Figure 15. **Position of the label on the carton box**

3.11.2 Dessicant and humidity indicators

Before the bag is sealed, one desiccant and one humidity indicator are placed with the shipping cassette.

Figure 16. **Dessicant indicator**

Figure 17. **Humidity indicator**



4 Storage and shipping requirements

4.1 Storage conditions

Store all packing material in an appropriate indoor area. This is to prevent any dust and/or damage from the sun, external light, and physical shocks.

Keep the temperature between 15ºC and 35ºC.

Keep the relative humidity range between 10% and 70% maximum.

Store the reconstructed wafers under vacuum, in their original supplied sealed packing until they are used.

After the packing seal is broken, store the reconstructed wafers under nitrogen (N_2) within dedicated closed shelves until they are processed.

Use the trace code to count the storage time. It is written on the labels placed on the reconstructed frame (see Section 3.8: Labels on the reconstructed frame), and on the STMicroelectronics' standard label (see Section 3.9.1: STMicroelectronics' standard label).

The maximum storage time of the reconstructed wafer is:

- Six months from the trace code date. This is when the wafer is kept in the original sealed packing.
- One week from the trace code date. This is when the original packing seal is open.

The maximum storage time defines the maximum time that can be waited for reconstructed wafer processing. Processing may be for picking and placing, and module integration. If the maximm storage time is not respected, safe processing is not guaranteed.

Warning: *If storage conditions and rules are not respected, STMicroelectronics' warranty is not valid.*

4.2 Shipping conditions

Ship the product during the full travelling time at a:

- Temperature between 15ºC and 35ºC.
- Relative humidity between 10% and 70%.

Revision history

Table 4. **Document revision history**

Date	Version	Changes
16-Oct-2023	1	Initial release
17-Nov-2023	2	Extended the scope of this technical note to all Imaging products. Improved the readability of the Introduction, Section 2: Reconstructed wafer traceability and emap bin format, and Section 3: Packing specifications.
06-Feb-2024	3	Updated document classification.

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