

Application Note Silicon Capacitor

Recommendations to handle bare dies

Rev. 1.6

This application note gives recommendations on how to handle bare dies* from Murata Integrated Passive Solutions. Bare dies should not be handled as chips in a package. This document is non-exhaustive. Customers with specific requirements that are not covered by this document should contact Murata (mis@murata.com).

This document highlights some specific effects which could harm the quality and yield of the production.

*separated piece(s) of semiconductor wafer that constitute(s) a discrete semiconductor or whole integrated circuit. International Electrotechnical Commission, IEC 62258-1, ed. 1.0 (2005-08).

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1. Handling Precautions and Storage

Silicon dies must always be handled with precaution in a dedicated environment for assembly. Regarding silicon capacitors, after opening of the packing, the remaining quantities have to be repacked immediately after any process step, in the same conditions as before the opening (ESD bag + N2 is usually preferred).

For specific storage conditions, please refer to the dedicated Application Note « Storage and shelf life conditions».

To avoid contamination and damage like scratches and cracks, our recommendations are:

- Die must never be handled with bare hands
- Avoid touching or scratching the active face with tools that are not adapted
- The mechanical pressure has to be limited
- Do not store and transport die outside protective bags, tubes, boxes, sawn tape
- Work only in ESD-controlled environments

Standard packing is tape & reel but silicon capacitors can be provided within waffle pack, gelpak or sawing frame. Please contact Murata for drawing and references (mis@murata.com).

2. Recommended tweezers

Any metal tweezer will damage (mechanically and electrically) the silicon capacitors. Please find below some examples of tweezers which are strictly forbidden for handling our bare dies.



Figure 1: Examples of metal tweezers unsuitable for picking up a bare Silicon Capacitor

With respect to the above comments, customers can use tweezers that are made in soft materials. For instance, tweezers made in plastic, or covered with soft material like torlon are perfectly suitable to handle our bare dies. If not possible to use tweezers with soft materials, ceramic tweezers can also be used with caution. For more information or for advice, please contact Murata.



Handling of bare dies with a vacuum tool is also possible and advised by Murata. More information can be found below.

3. Delivery Forms

Bare dies are delivered either as unsawn wafers, as sawn wafers on foil or as separated dies. Murata can deliver E-mapping with wafers, so please refer to the E-mapping file from wafer test (formats: SINF, eg4k...) for good dies information, especially when it is picked from Film Frame Carrier (FFC).

For more information about storage conditions, please refer to the dedicated Application Note "Storage and Shelf life conditions".

Unsawn wafers are generally delivered in dedicated protective boxes.

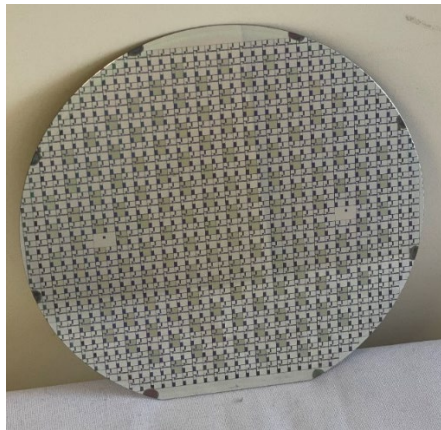


Figure 2: Unsawn wafer

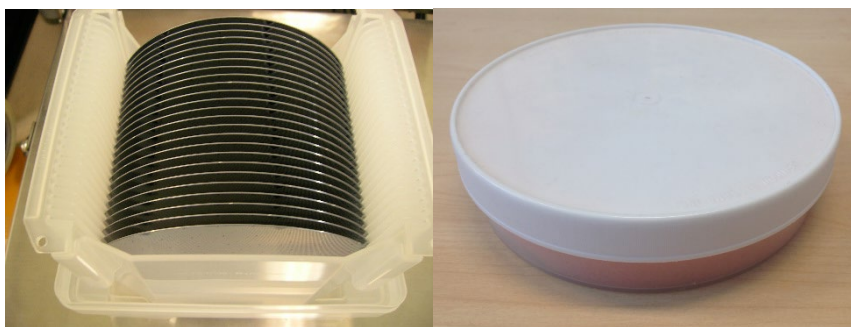


Figure 3: Unsawn wafer in open wafer box (left) and storage round container for multiple wafers (right).



In case the delivered wafer is sawn, it will generally be packed as FFC. Expander grip ring is also an option.

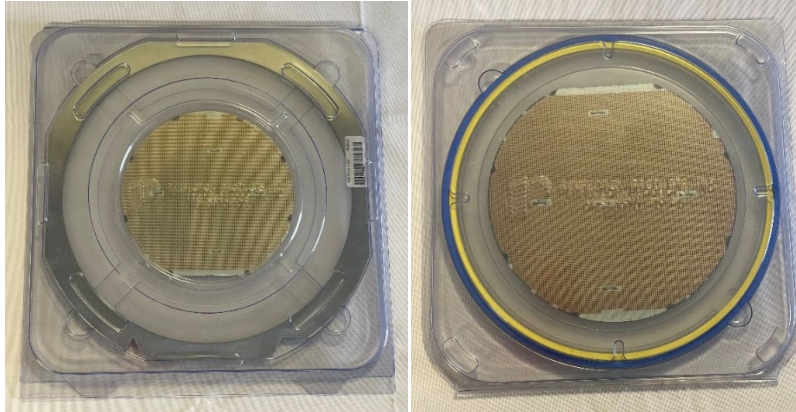


Figure 4: Sawn wafers on Film Frame Carrier (left) and expander grip ring (right), within their plastic transportation boxes

In the case of singulated dies, tape and reel, gel packs and waffle packs are available as packing options.

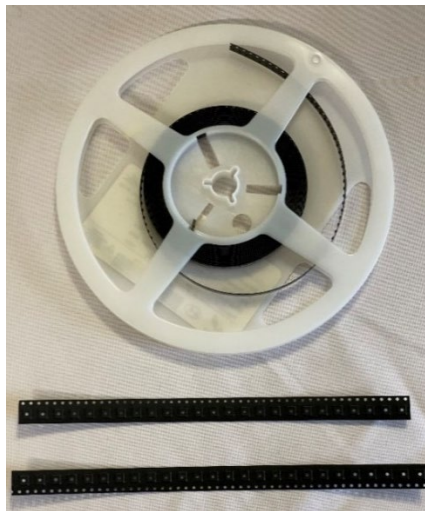


Figure 5: Tape and reel with cut tape on bottom



Figure 6: Gel pack and waffle pack for bare dies



4. Die Handling

Silicon dies must always be handled with precaution in a dedicated environment compatible with assembly operations, like a grey room for instance. Unpacking and inspection, die bonding, wire bonding, molding, sealing and handling must be reduced to the absolute minimum and un-necessary inspections or repacking tasks have to be avoided. Please note that assembled devices do not need to be handled in a specifically clean environment since the product is already well packed. Please check the IPC-A-610 standard about handling of electronic components.

Murata also manufactures very-thin dies, below 50µm. Please contact Murata if your application requires capacitors or IPDs with a thickness of 50µm or less.

As much as possible, usage of complete packing units (waffle pack, FFC, tape and reel...) is recommended and remaining quantities have to be repacked immediately after any process (e.g. picking) step. When using Gel pack, we recommend to place the bottom side of the pack under vacuum to ease handling of the Silicon dies.

To avoid contaminations and damages (scratches, cracks):

- Dies or wafers must never be handled with bare hands
- Avoid touching or scratching the active face with tools that are not adapted
- The mechanical pressure has to be limited
- Do not store and transport dies outside protective bags, tapes or boxes
- Work only in ESD safe environments

Dedicated tweezers are suitable for grabbing a wafer by its edge (see Figure 7). Murata highly recommends using such tweezers for unsawn wafers handling.

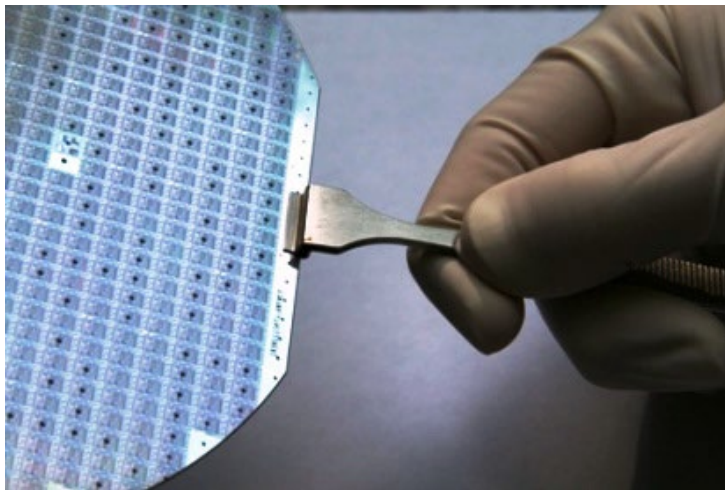


Figure 7: Special tweezers for grabbing a wafer



5. Nozzle selection

Vacuum pick-up tools are advised for picking dies (see figure 8).

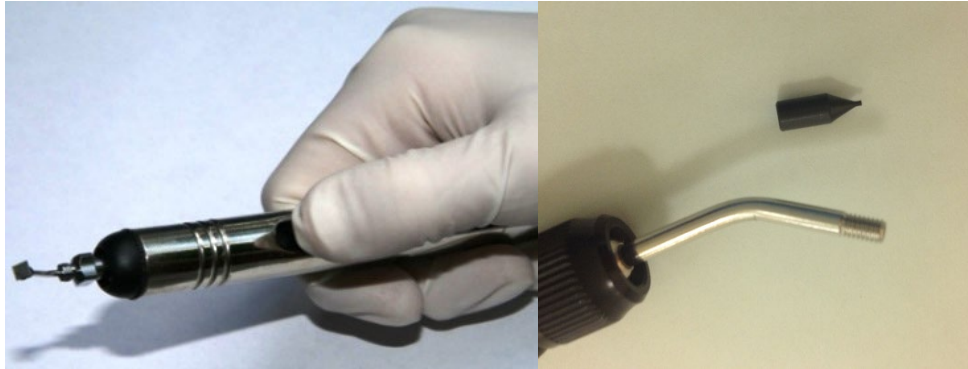


Figure 8: On the left, die on a vacuum pick up tool, on the right, vacuum pick-up tool and a nozzle

The nozzles of the vacuum pick up must be made of soft materials like Teflon®, Delrin®, PEEK, conductive nylon or non-conductive rubber, with a preference for molded nozzles. Ceramic or metal nozzles are strongly not recommended. Further, the nozzles must be chosen according to the die size, their own size and the temperature, so it's application dependent. For more information on die size, please refer to the product datasheet, our Assembly notes or please contact Murata.

Murata advises to use replaceable nozzles. If you are facing sticky dies, you may try Delrin® material to solve it only if your handling application is below 135°C. Please refer to your nozzle manufacturer's documentation.

Below, we propose some nozzle recommendations for various chip sizes, not exhaustive. Please check with your nozzle supplier which size fits the best around those values, considering materials dimensions and tolerances.

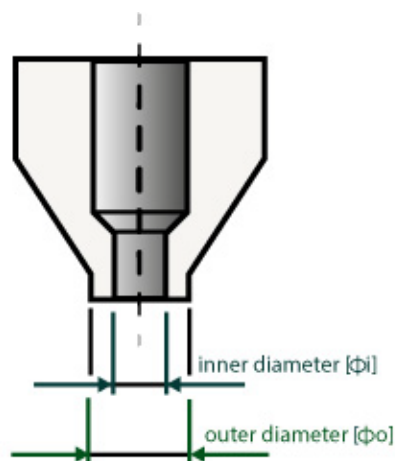


Figure 9: Typical nozzle schematic



| Case size | Inner diameter (ϕ i) in mm/inches | Outer diameter (ϕ o) in mm/inches |
|---------------|---|---|
| 01005M | Maximum 0.15mm/0.006" | Maximum 0.40mm/0.016" |
| 0201M | Between 0.15mm/0.006" and 0.25mm/0.010" | Between 0.35mm/0.014" and 0.55mm/0.022" |
| 0201 | Between 0.30mm/0.012" and 0.55mm/0.022" | Between 0.60mm/0.024" and 0.8mm/0.032" |
| 0402M | Between 0.25mm/0.010" and 0.45mm/0.018" | Between 0.55mm/0.022" and 0.9mm/0.036" |
| 0402 | Between 0.35mm/0.014" and 0.65mm/0.026" | Between 0.70mm/0.028" and 1.2mm/0.048" |
| 0603 | About 0.65mm/0.026" | About 1.50mm/0.060" |
| 0101 | Between 0.10mm/0.004" and 0.20mm/0.008" | Between 0.25mm/0.010" and 0.45mm/0.018" |
| 015015 | Between 0.15mm/0.006" and 0.30mm/0.012" | Between 0.40mm/0.016" and 0.60mm/0.024" |
| 0202 | Between 0.25mm/0.010" and 0.45mm/0.018" | Between 0.55mm/0.022" and 0.8mm/0.032" |
| 0303 | Between 0.40mm/0.016" and 0.70mm/0.028" | Between 0.80mm/0.032" and 1.10mm/0.044" |
| 0404 | Between 0.50mm/0.020" and 0.90mm/0.036" | Between 1.00mm/0.040" and 1.40mm/0.056" |
| 0502 | Between 0.25mm/0.010" and 0.45mm/0.018" | Between 0.60mm/0.024" and 1.00mm/0.040" |
| 0505 | About 0.70mm/0.028" | About 1.40mm/0.056" |

Table 1: Recommendations for nozzles' dimensions

For bigger chip sizes in square shape, we advise to use a nozzle with an inner diameter of roughly 0.6 times the capacitor's width and an outer diameter of roughly the capacitor's diagonal. For other specific needs, please contact Murata.

Nozzle dimensions must match to your handling equipment. Minimal suction pressure is 50g for smallest dies (width below 0.5mm) and go up to 150g for chips larger than 1mm².



Revision history

| Revision | Date | Description | Author |
|----------|------------|---|-----------|
| 1.5 | 27/05/2021 | New format and nozzle selection added | C. Muller |
| 1.6 | 19/01/2023 | Update on storage and assembly conditions | K. Dubois |

Disclaimer / Life support applications

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