Innodisk
Module Handling Guide Book

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Rev. 1.0

Module Handling Guide Book

- **Introduction**
- **Understanding Memory modules**
  - Understanding VLP
  - Module review (structural weak point)
  - Module Components
- **Proper Handling Procedures**
  - Proper/Incorrect Handling Demo
  - DRAM IC / FBGA package / MLCC / Resistor Handling
  - ESD
  - Storage (Tray Packaging)
  - Proper Installation and Uninstallation Procedures

Introduction (Overview)

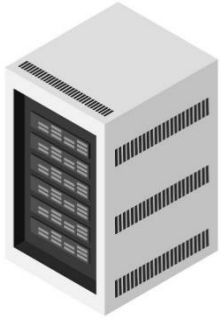
- Through our long-term analysis of the root causes of failed products, most failures result from incorrect operational procedures or mechanical damage. These factors can lead to immediate or future errors during startup or memory malfunctions.
- As technology advances, components become smaller and thinner, circuit layouts become more dense, and module operation speeds increase. Errors arising from these factors become more pronounced.
- Therefore, all products should be handled and used with greater care to prevent any subtle damage.
- For example, in products like Registered DIMM and VLP series, the required components are more numerous, but the available space is shrinking. VLP, for instance, is only half the width of regular products, making it more susceptible to inadvertent contact with the components. This can lead to various types of damage, which may not always be evident in the external appearance of the components. Some subtle internal damages may only become apparent after prolonged use or under specific conditions, ultimately causing product failure.
- Furthermore, electrostatic damage from incorrect handling is also common in memory modules. If electrostatic charges occur, serious malfunctions can ensue. Therefore, all products must be operated in an anti-static environment, and operators are advised to wear anti-static gloves, cloths, shoes, or other appropriate equipment at all times to prevent additional damage caused by static electricity.

◆ **This guide book will present some cases of errors resulting from incorrect operations and mechanical damage. These cases are based on a lot of investigations and experiments for a long time , and aim primarily to reduce potential future errors and control product damage caused by incorrect operations. The main purpose is to reduce wrong handling and to assist customers in maintaining a safe operating environment.**

Understanding Memory modules

- Register DIMM (RDIMM)

For server



- Unbuffered DIMM (UDIMM)

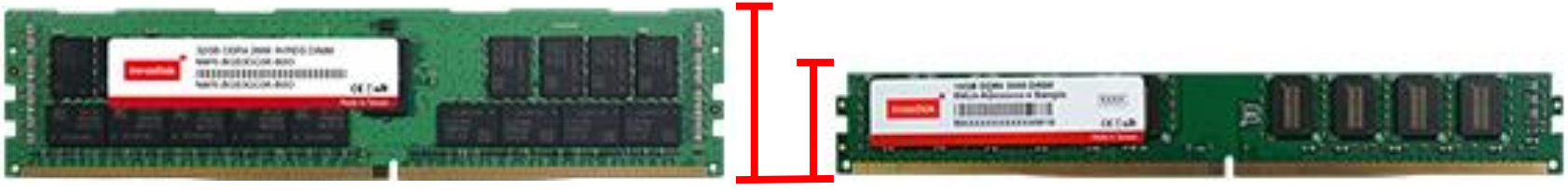
For Desktop

- SODIMM

For Notebook

Understanding VLP

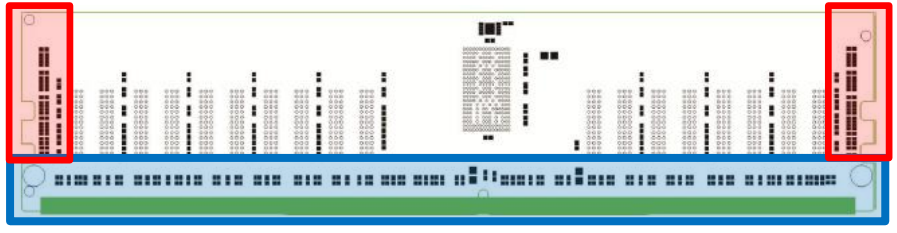
- What is VLP ?
  - VLP (Very Low Profile) DRAM is a space-saving memory module that is 40% smaller than the standard module. It is compatible with 1U devices or any embedded PCs with space-limited applications, and is helpful in improving the system's heat dispersal capabilities.

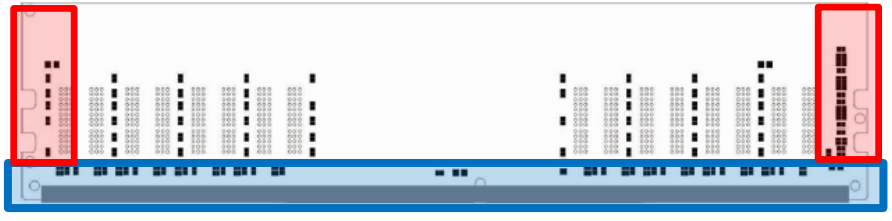


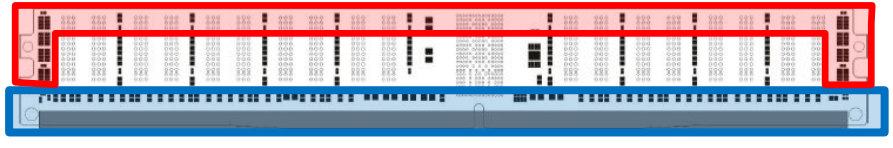
Standard

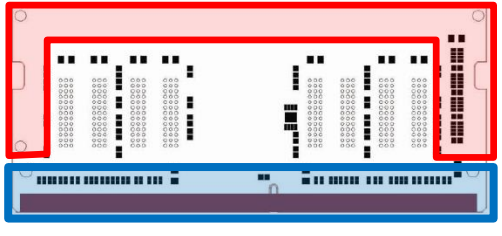
VLP

Module review (structural weak point)


RDIMM


UDIMM


VLP


SODIMM

Weak Point
(Components Crack, Damage, Missing)

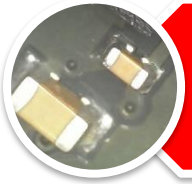
- Major Cause by **Handling**

Weak Point
(Components Missing)
(PCB Damage, Scratch)
(Components Sulfuration)

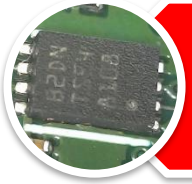
- Major Cause by **Handling**
- **Socket or Socket JIG**
- **Environmental corrosion**

Schematic diagram, the actual situation is subject to the actual product.

Module Components

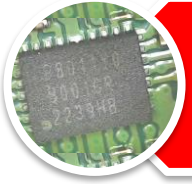


MLCC
MLCC is the abbreviation of
"Multi layer Ceramic Capacitor".

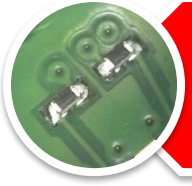


EEPROM
EEPROM is the abbreviation of
"Electrically erasable programmable read only memory".

A/R
A/R is the abbreviation of
"Array Resistor".

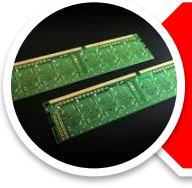


PMIC (DDR5)
PMIC is the abbreviation of
" Power Management IC "
This component used only in DDR5



Chip Resistor
C/R is the abbreviation of
"Chip Resistor".

RCD (Register CLOCK DRIVER)
Register is a component used only in **RDIMM** (Registered DIMM).



PCB
PCB is the abbreviation of
"Print circuit board".

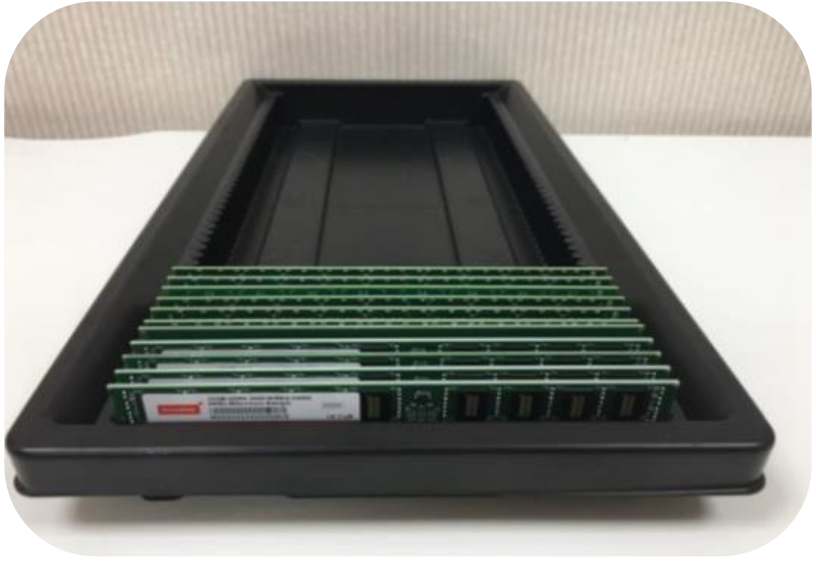
DRAM IC
IC is the abbreviation of
" Integrated Circuit "

Proper Handling Procedures

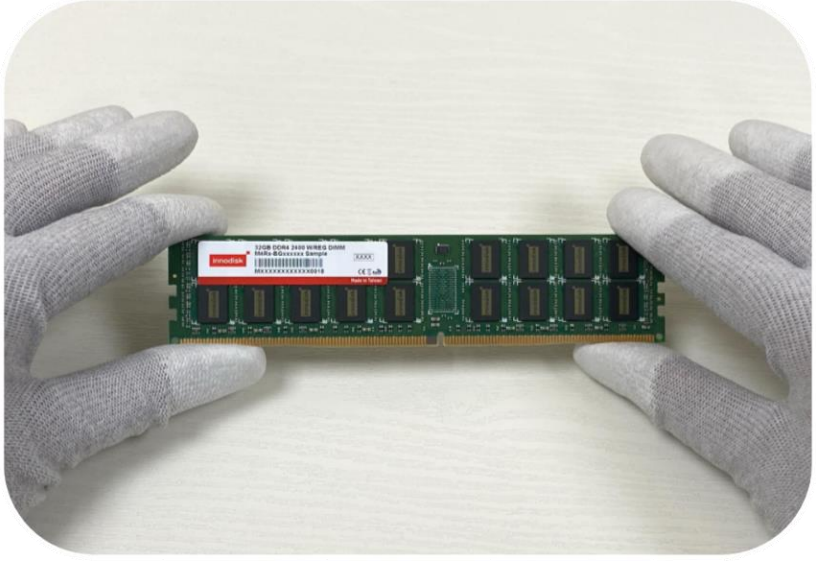
- This chapter will demonstrate and explain the correct and incorrect ways to handle modules.
- Any actions that could potentially damage the module components should be approached with extra caution.
- If improper handling leads to product damage, it will be assessed following RMA guidelines.
- The following information provides a brief overview of the specifications related to artificial damage :
  - **Products which defect due to mishandling, abuse, misuse, neglect or repair by users are out of RMA service, and need to be charged.**

Proper Handling Procedures

- **Proper Handling**



Modules must be stored in a right tray.

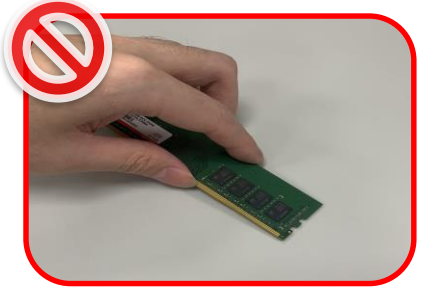


Hold one module at a time.
Hold both side with both hands
Avoid touching DRAM IC

Proper Handling Procedures

- **Incorrect operation**

Touch the gold fingers / IC

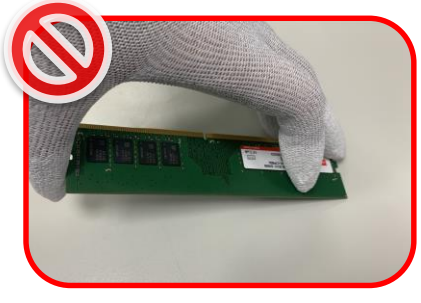


Pick-up by press gold fingers

Hold the DIMM using 3 points

Drop the module

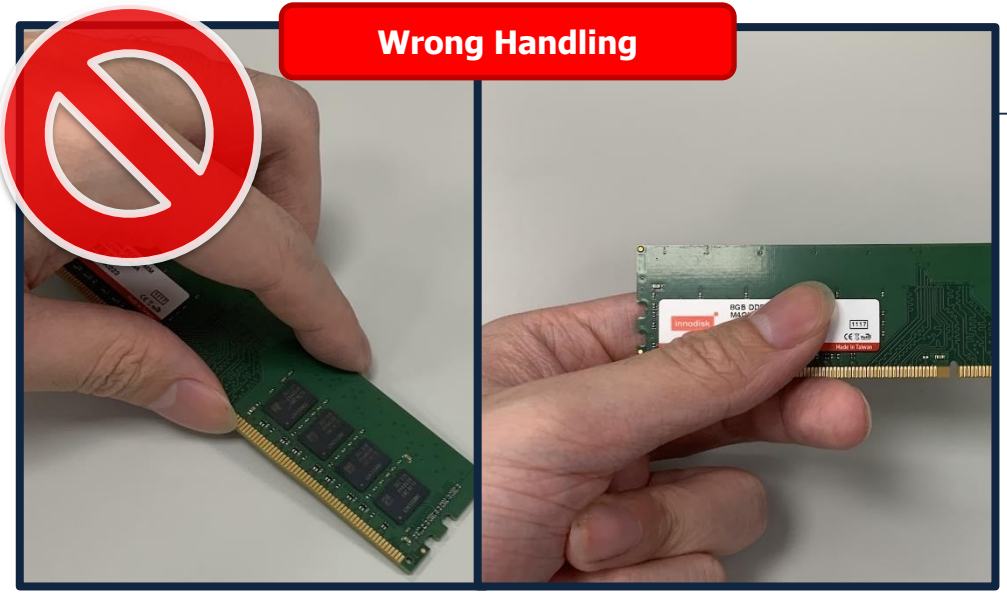
Twist or bend module



Press one side and pull up

Hold more than one pcs together

Stack two or more DIMM



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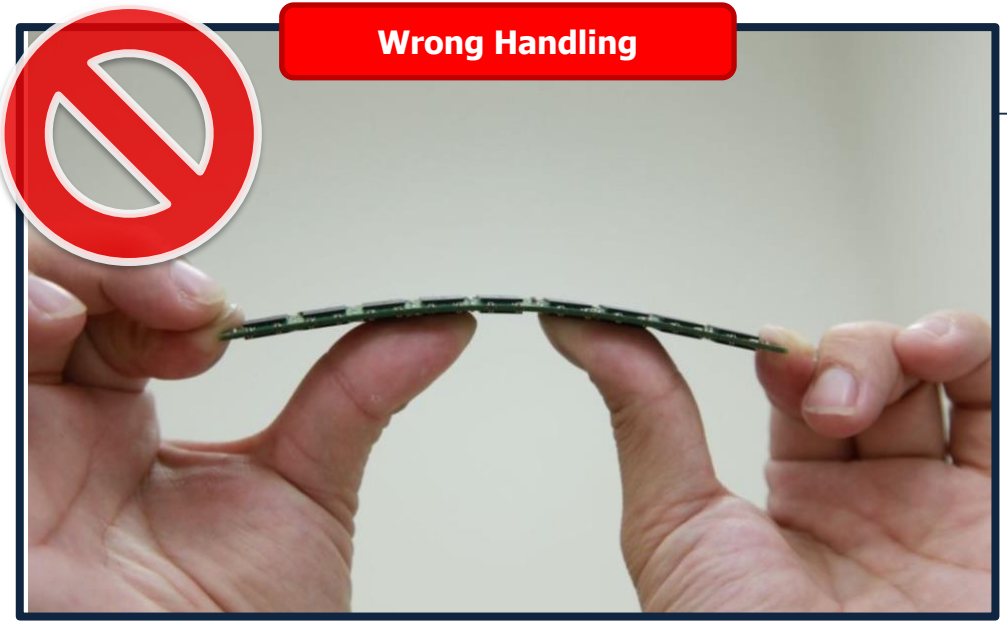
- **Damage Type :**

- **Do not touch the gold finger with bare hands.**

  - Gold finger pollution
  - Fingerprint residue
  - Potential contamination



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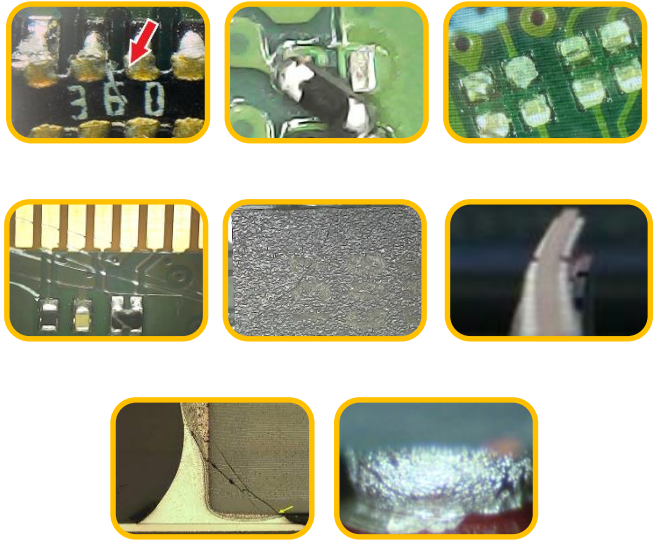
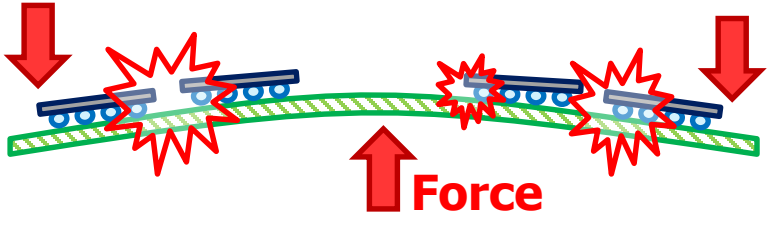
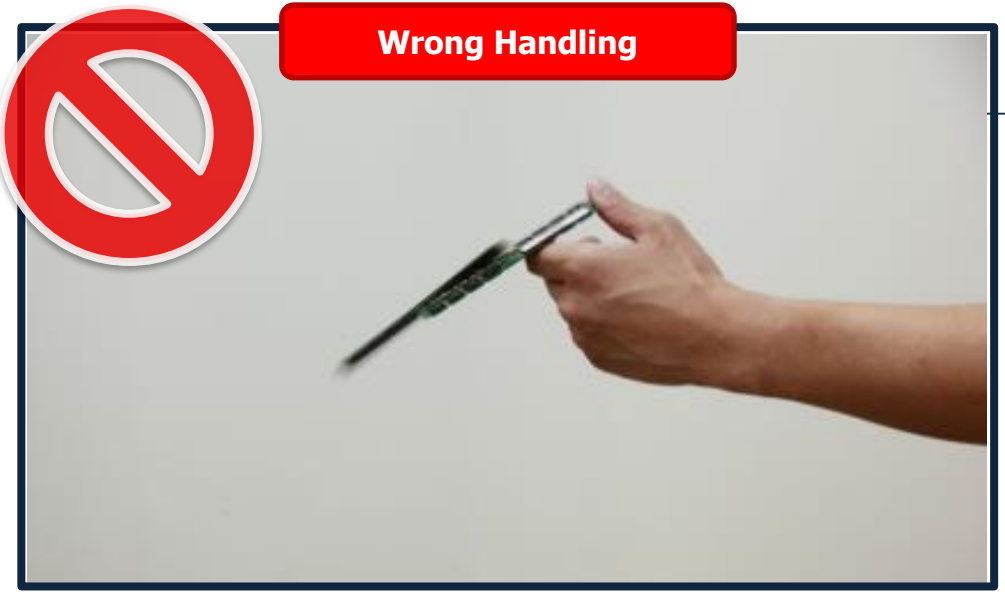
- **Damage Type :**



☐ Do not Twist or Bend module

- Components crack
- Components missing
- Solder ball crack
- PCB crack / Bend





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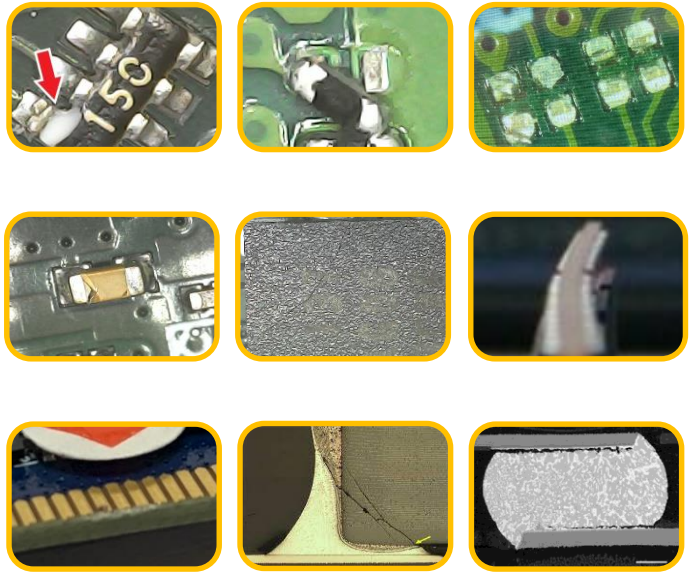
- **Damage Type :**



☐ Do not drop the module

- Components crack
- Components missing
- Components internal damage
- Solder ball crack
- PCB damaged / Bend

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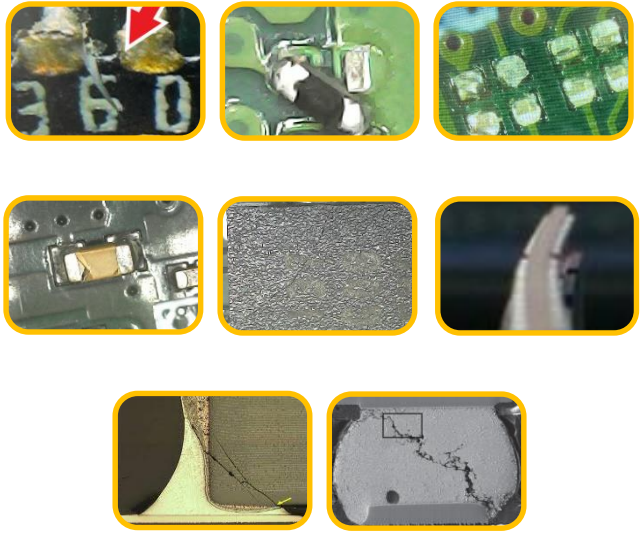
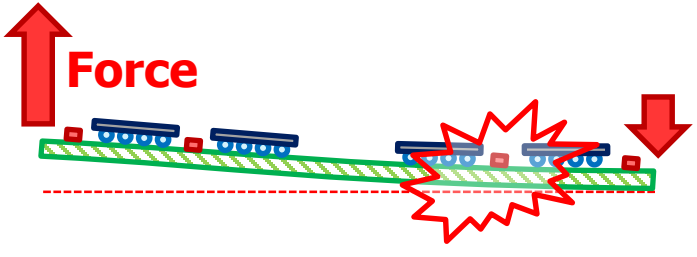
- **Damage Type :**

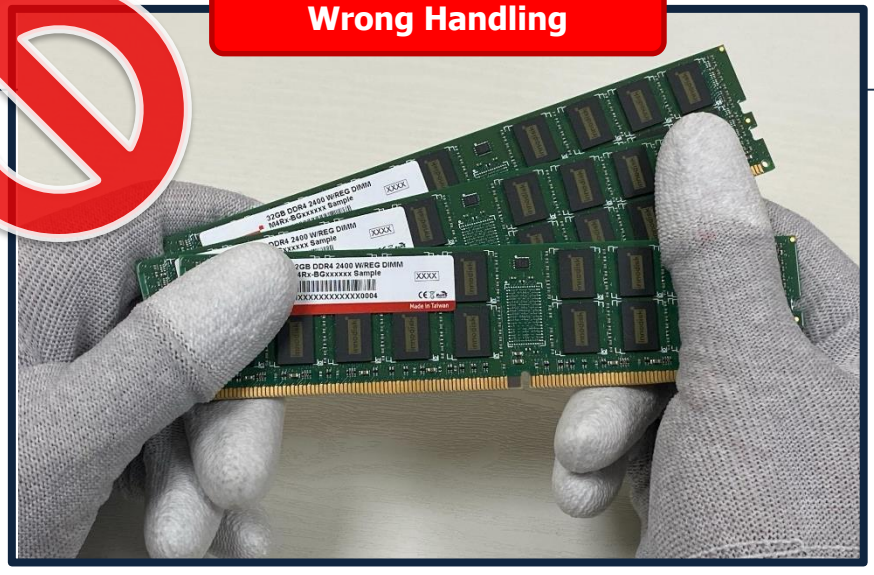


☐ Do not press one side and pull up

- Side components crack
- Side components internal damage
- Solder ball crack
- PCB damaged / Bend



Wrong Handling



- **Do not hold more than one pcs together.**

- Collision damage
- Components crack
- Components internal damage
- Solder ball crack
- PCB damaged / Bend / Scratch

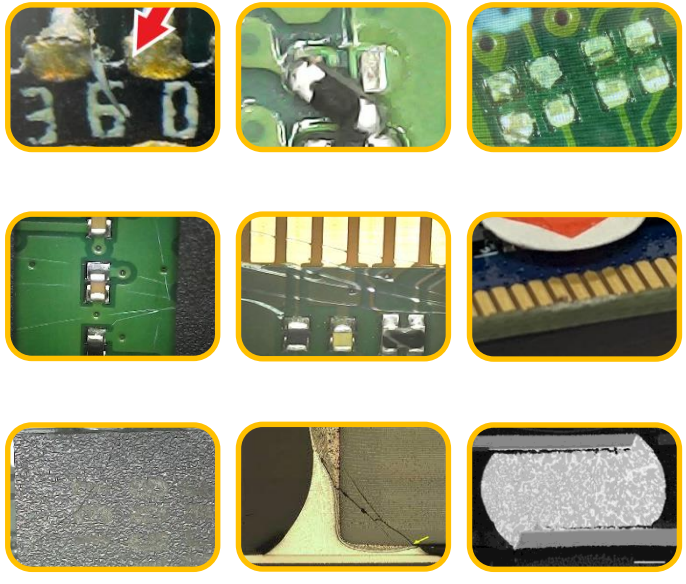
Damage Type :

Wrong Handling

- **Do not stack two or more DIMM**

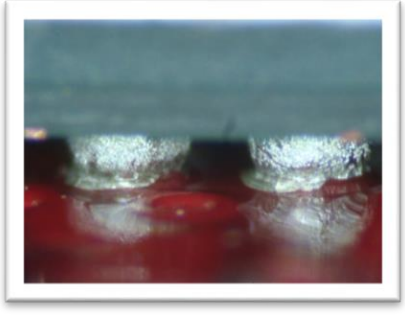
- Collision damage
- Components crack
- Components internal damage
- Solder ball crack
- PCB damaged / Scratch

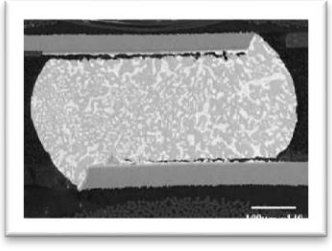
- **Damage Type :**



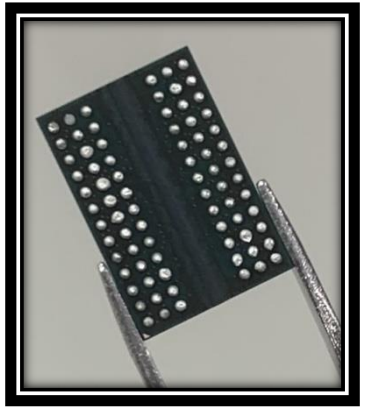
DRAM IC / FBGA package

- The DRAM IC with FBGA package are crucial components of the memory. Any inappropriate force applied to them from above can potentially result in damage.
- The damage on the solder ball is particularly crucial.
- **Most damages are not visually detectable.**



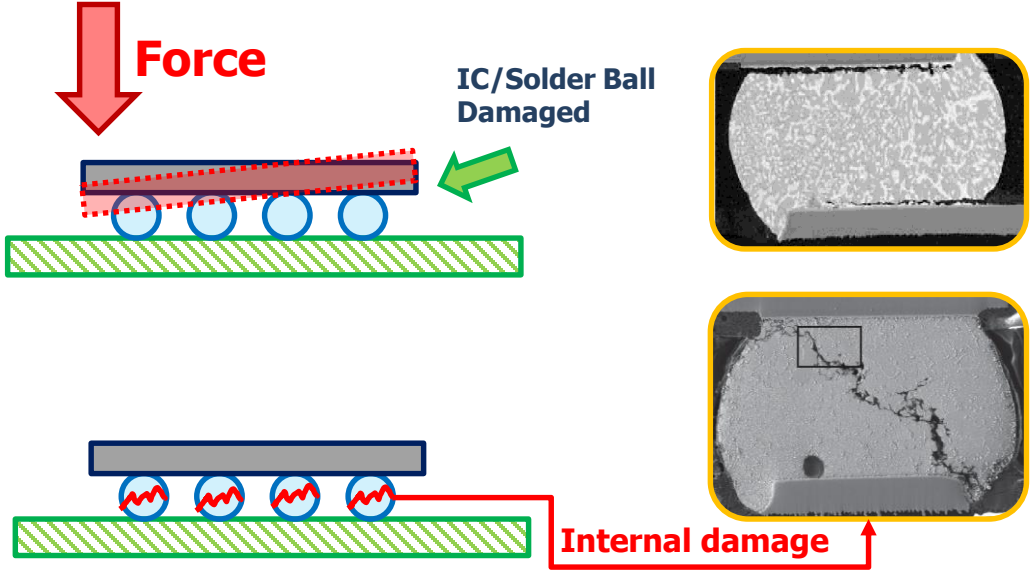


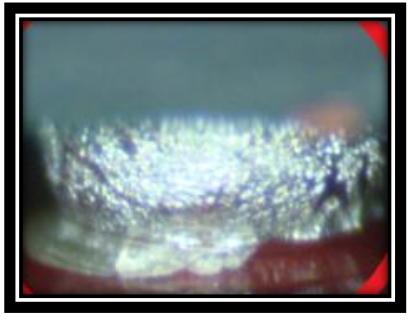
- **This image simultaneously shows one normal solder ball and one damaged solder ball.**



Proper Handling Procedures (FBGA)

- FBGA solder ball cannot be used as a stress buffer, as any excessive force on IC may lead to damage to the solder ball or IC itself.

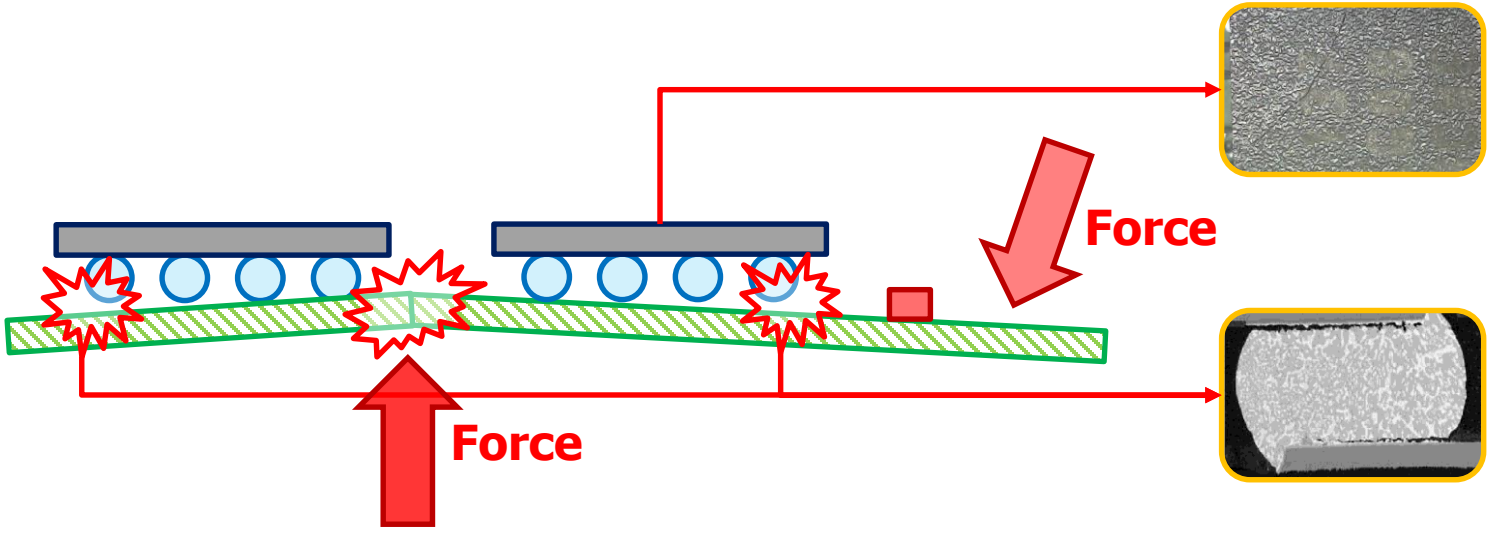




◆ Solder Ball Damaged

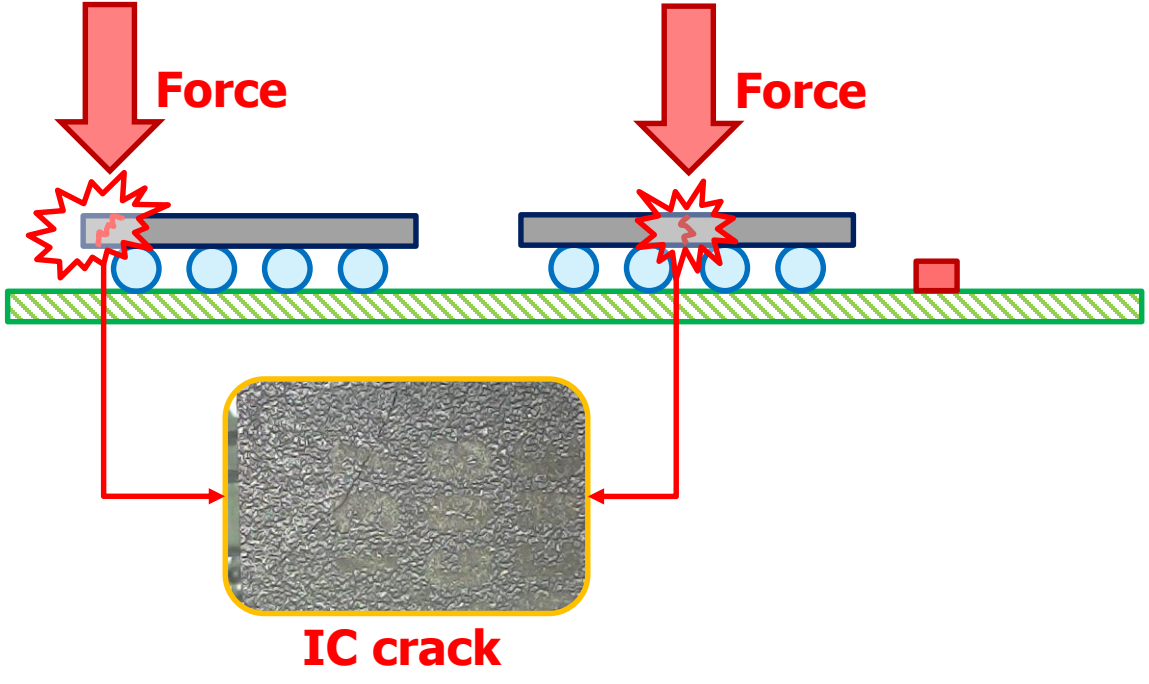
Proper Handling Procedures (FBGA)

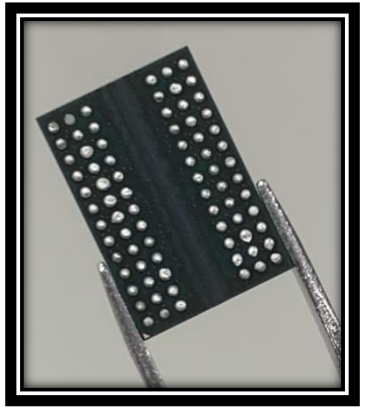
- Any force that causes the PCB to bend or twist has the potential to damage the solder balls of the FBGA or cause damage to the IC connections.



Proper Handling Procedures (IC)

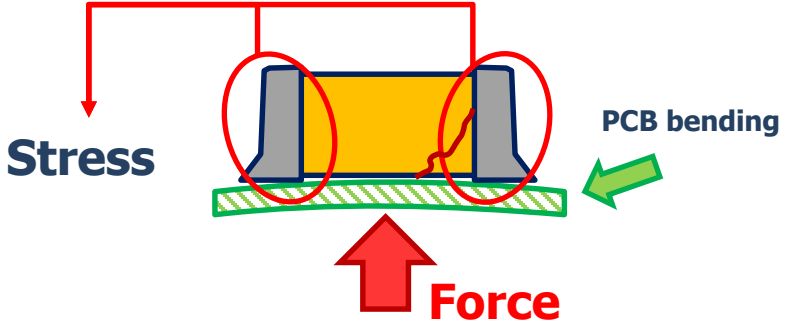
- DRAM IC is located the top point that is cracked easily by external damage or external pressure

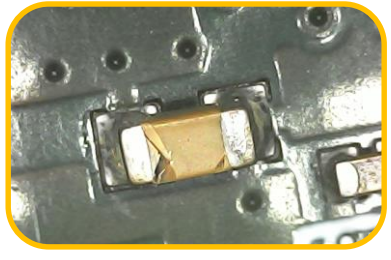


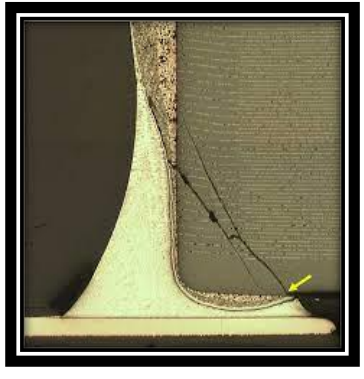


Proper Handling Procedures (MLCC)

- MLCCs are susceptible to damage from stress imposed by the PCB. Due to structural factors, they are more prone to develop imperceptible cracks.
- Such cracks can lead to circuit instability during future use, posing challenges for both utilization and analysis.
- Most damages result from **PCB bending and impact.**

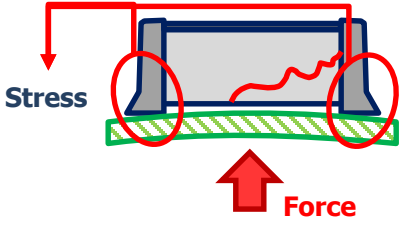


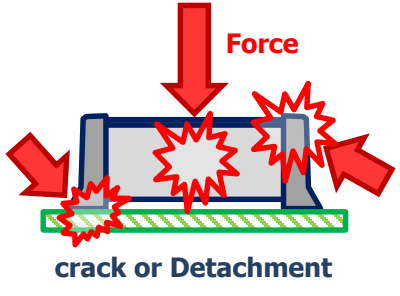


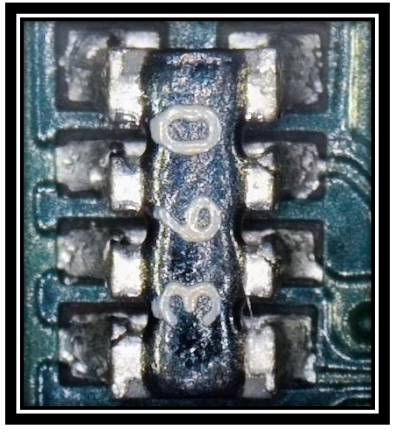


Proper Handling Procedures (Resistors)

- Resistors are susceptible to damage or detachment due to inappropriate external forces, especially some modules that use significantly small resistors.
- Resistors are also susceptible to damage caused by PCB deformation due to stress, or caused by unstable currents.
- Most damages result from **Collision damage.**







ESD (Electrostatic Discharge)

- Electrostatic discharge can have significant detrimental effects on the manufacturing process, leading to functional failures in solid-state electronic components such as ICs.
- These electronic devices may suffer permanent damage when exposed to high voltages.
- Therefore, it is recommended to implement measures to prevent the accumulation of electric charges, such as avoiding materials with high charge, and measures to eliminate static electricity, such as grounding workers, providing anti-static clothing, and controlling environmental humidity.
- This helps release static electricity and establishes an electrostatic protected area free from static charges.

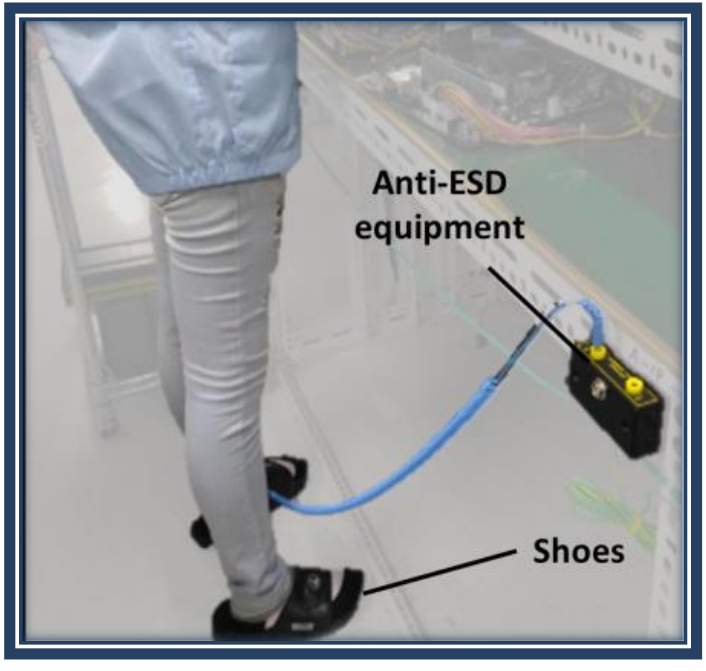
ESD (Electrostatic Discharge)

- **Proper Workwear (Sample)**

- All personnel handling the modules should ground themselves by wearing following equipment to avoiding any contamination.
  - Antistatic clothing
  - Head cover
  - Anti-ESD equipment
  - Anti-ESD shoes
  - Anti-ESD gloves

ESD (Electrostatic Discharge)

- **Anti-ESD equipment**



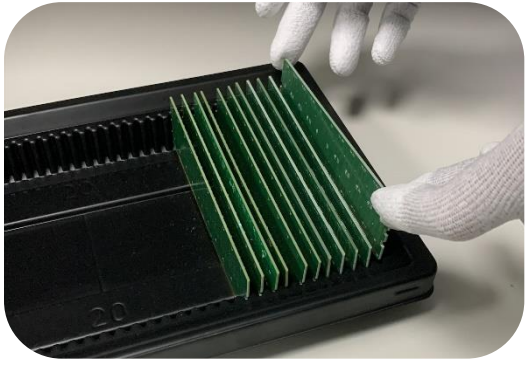
- When using Anti-ESD equipment , ground wire should be connected for safety and avoid product damaged by electro static.

Storage (Tray Packaging)

- **Proper Handling**

Modules must be stored in a Right tray.

Tray must be covered with Tray Cover when handling module tray.



Use both hands to firmly hold the module by its edges. (avoid touching component area)

Wrong Handling

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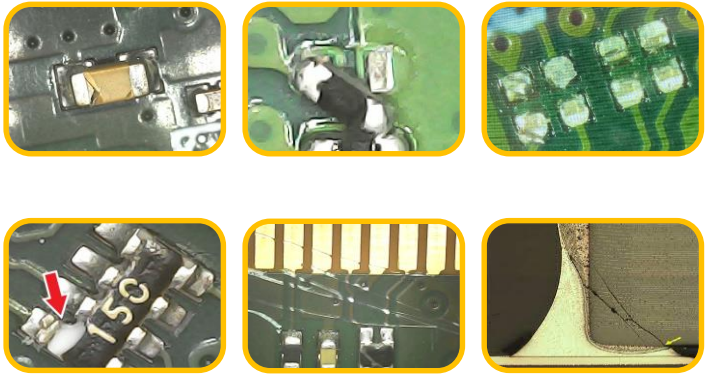
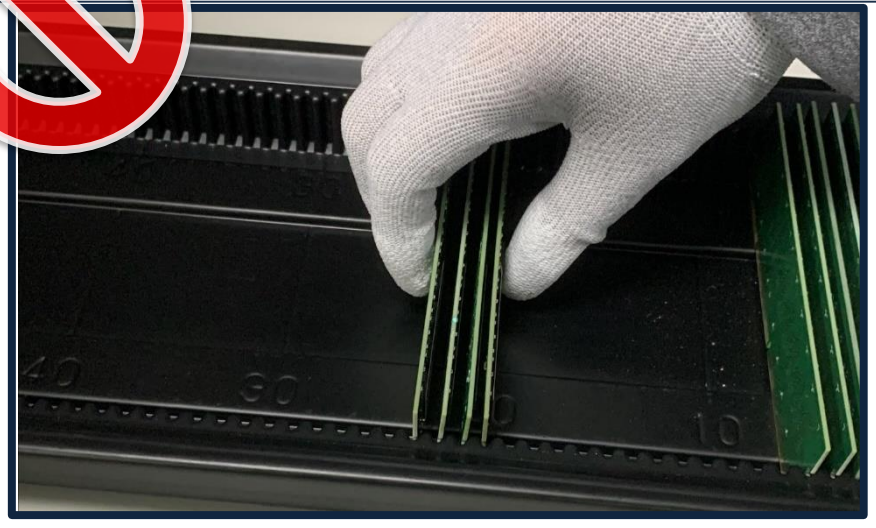
- **Damage Type :**



- **Do not overlapping modules in adjacent slots.**
  - Collision damage
  - Side components crack
  - Side components internal damage
  - PCB damaged / Scratch
  - Unexpected force

Wrong Handling



- **Do not take more than one module at a time**
  - Collision damage
  - Components crack
  - Components internal damage
  - Solder ball crack
  - PCB damaged / Bend / Scratch

- **Damage Type :**

Wrong Handling

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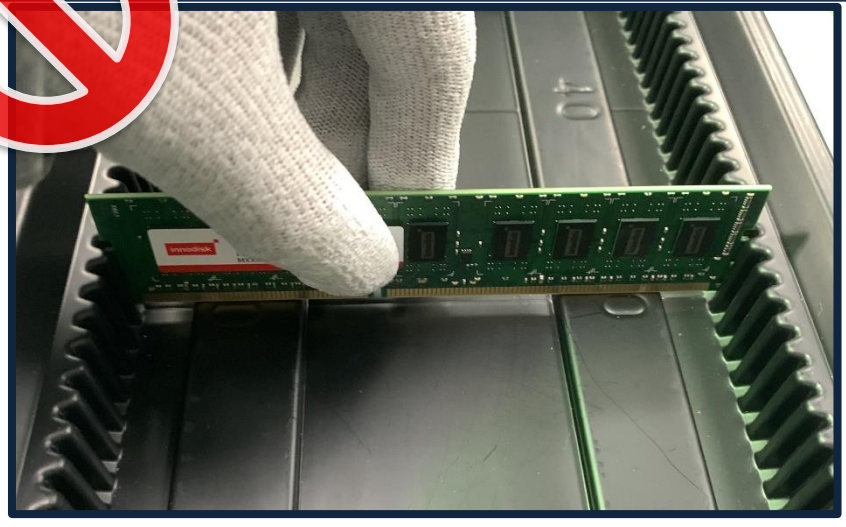
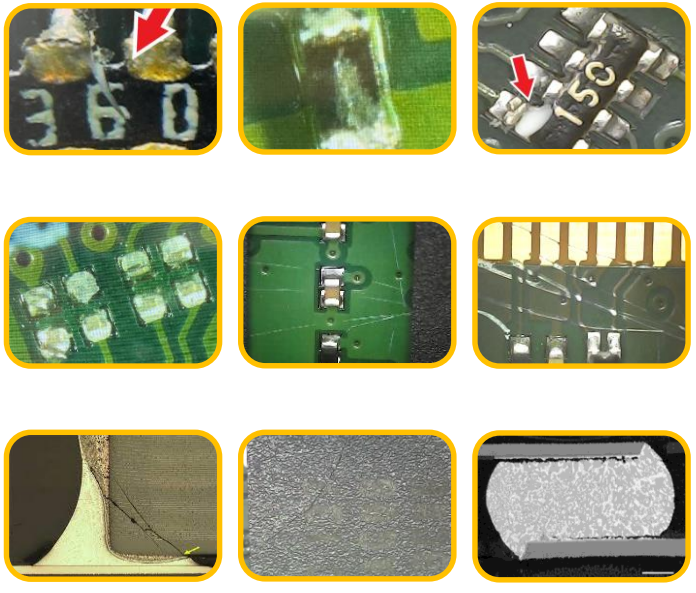
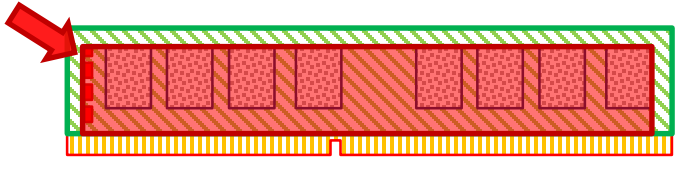


- **Damage Type :**



- **Please avoid touching the component area directly when handling the module.**

  - Components crack
  - Components internal damage
  - Solder ball crack
  - PCB Scratch



Wrong Handling

☐ Do not use the wrong tray

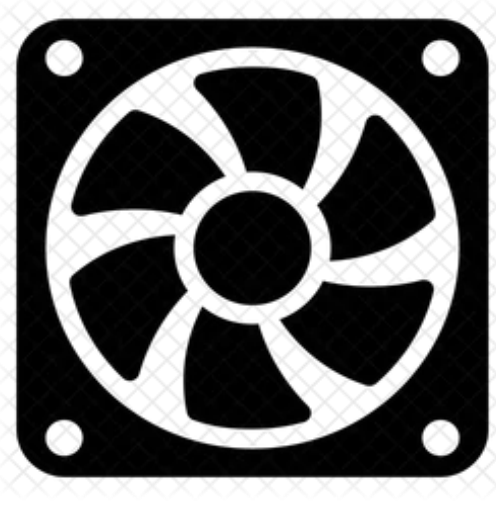
- Collision damage
- Module Falling
- Overlapping
- PCB Scratch

● Damage Type :

Proper Installation and Uninstallation Procedures

- **Proper Handling (First check)**

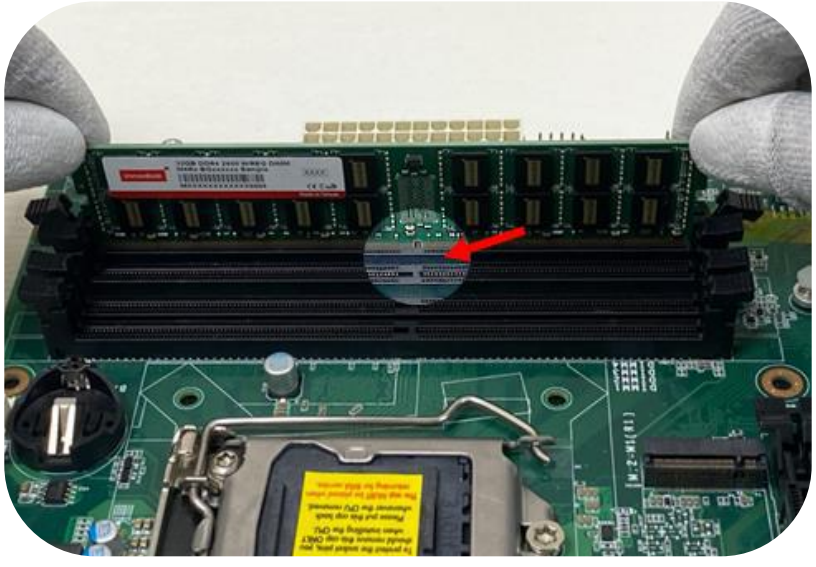
Check that the system is
Powered OFF Completely



Check that the fan has
Stopped Completely

Proper Installation and Uninstallation Procedures

- **Proper Handling (Installation U/R/VLP DIMM)**



Align the module notch to the socket.

Insert the module horizontally in the socket, both side with the same height

Avoiding gold finger to be scratched.

Press top of the module at both side

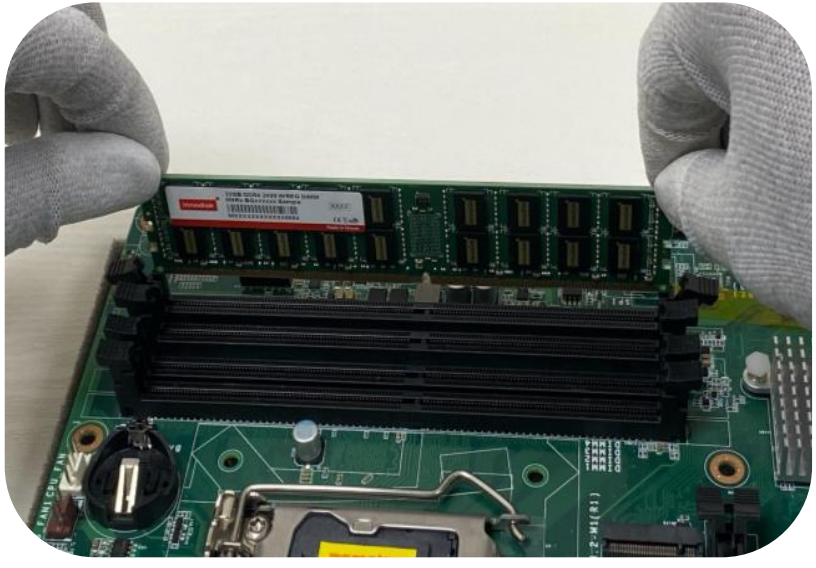
until a "click" sound and make sure the socket fit with the module.

Proper Installation and Uninstallation Procedures

- **Proper Handling (Uninstallation U/R/VLP DIMM)**

Open the socket levers.

Until module is pushed upward



When the module is pushed upward

Pick the module up from both side horizontally.

Wrong Handling

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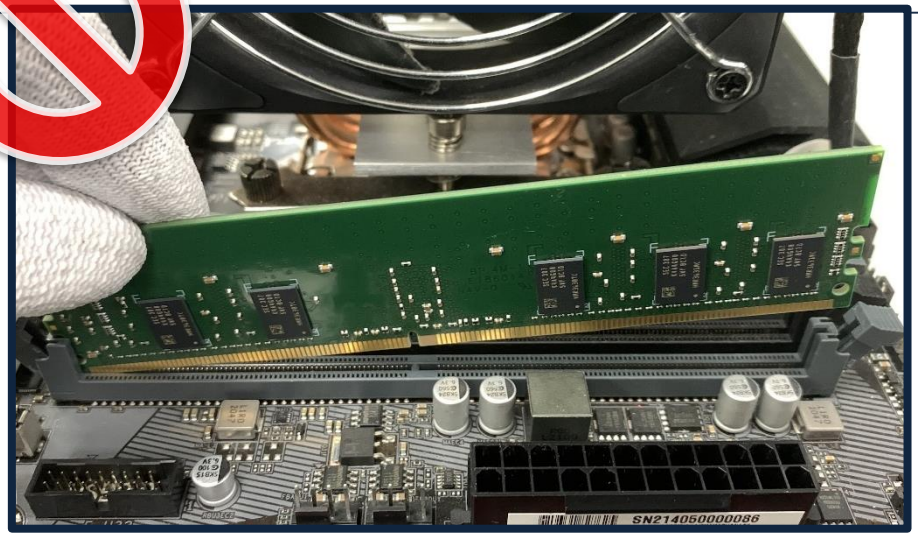
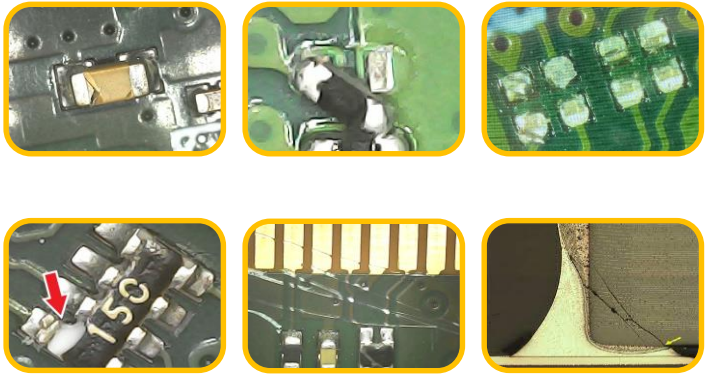
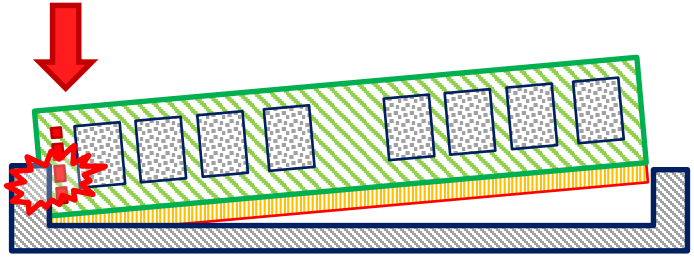


- **Damage Type :**

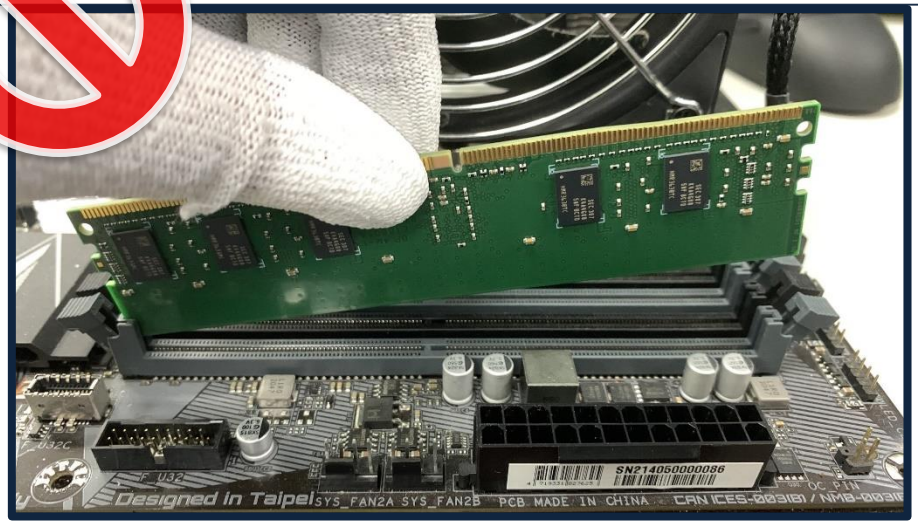


☐ Do not insert/extract module Unevenly

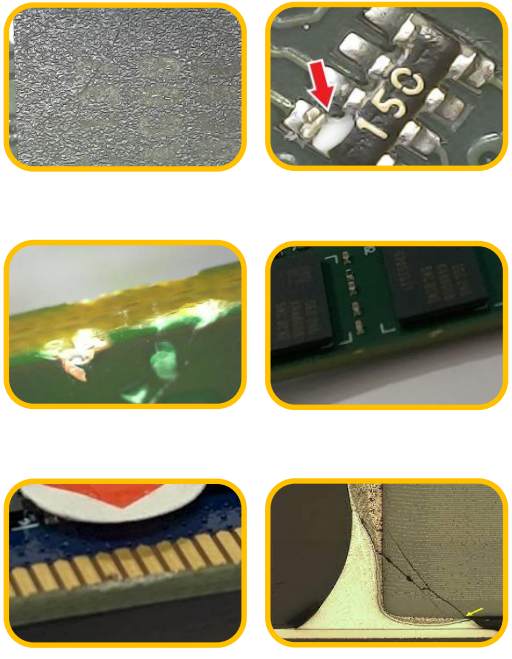
- Collision damage
- Side components crack
- Side components internal damage
- PCB damaged / Scratch
- Unexpected force



Wrong Handling



- **Damage Type :**



☐ **Do not insert/extract module upper side.**

- Collision damage
- Components crack
- PCB damaged / Scratch
- Unexpected force

Wrong Handling

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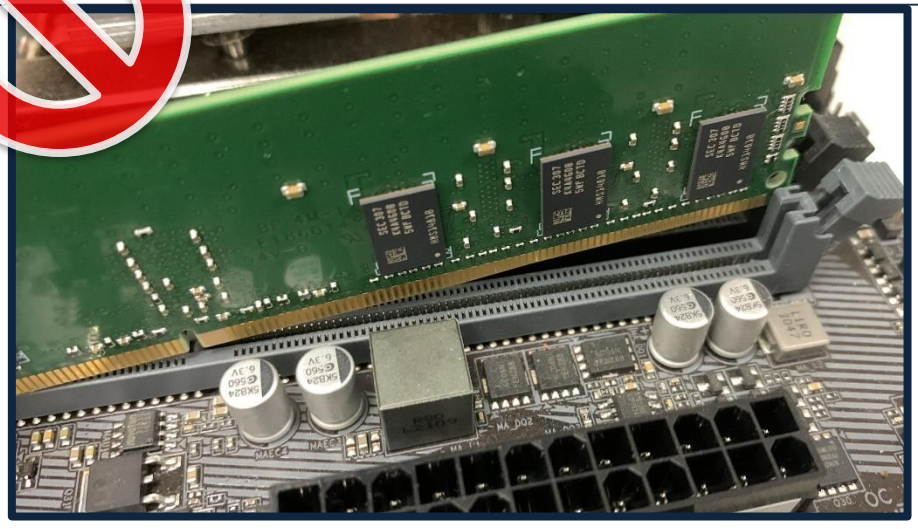
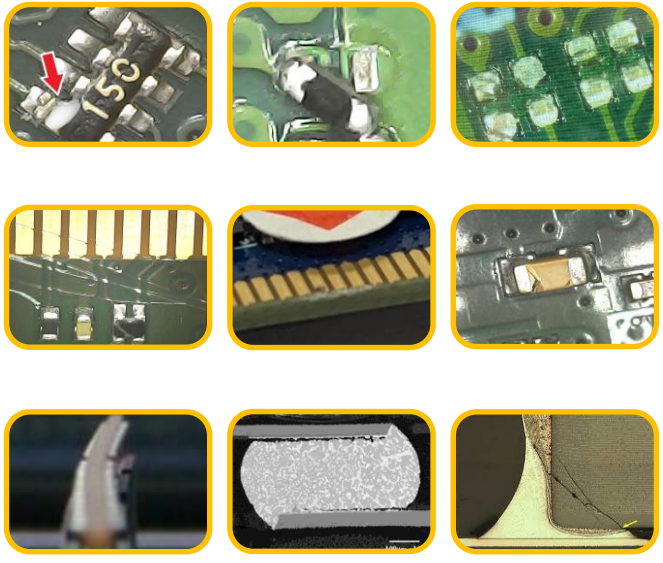
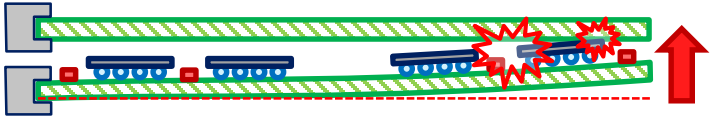


- **Damage Type :**



☐ Do not insert module between sockets.

- Twist damage
- Side components crack
- Side components internal damage
- PCB damaged / Scratch / Bend
- Unexpected force



Wrong Handling

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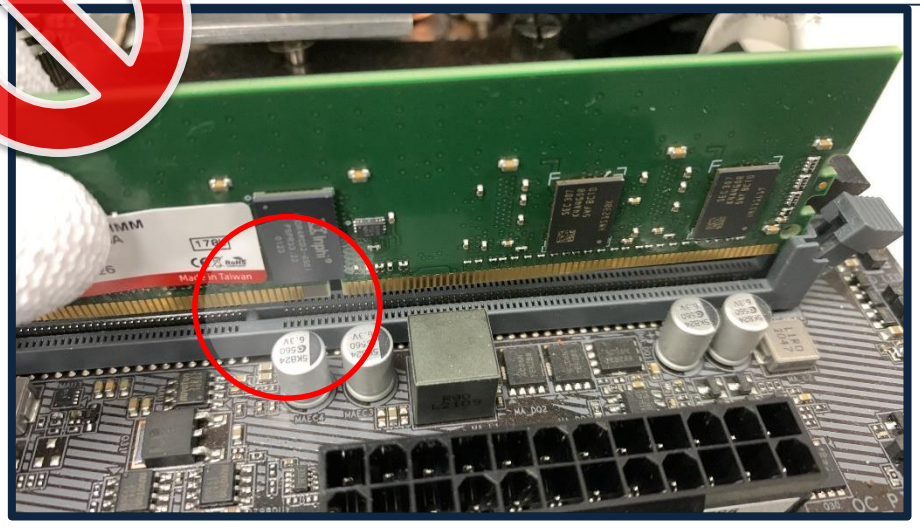
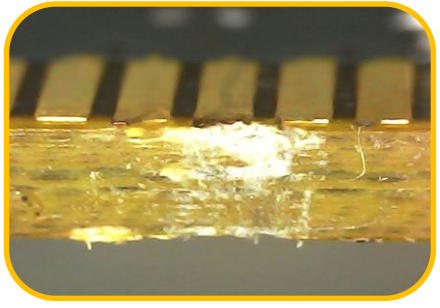
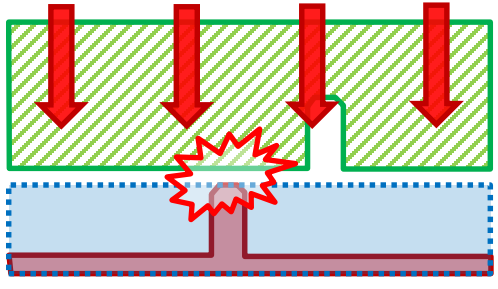


- **Damage Type :**

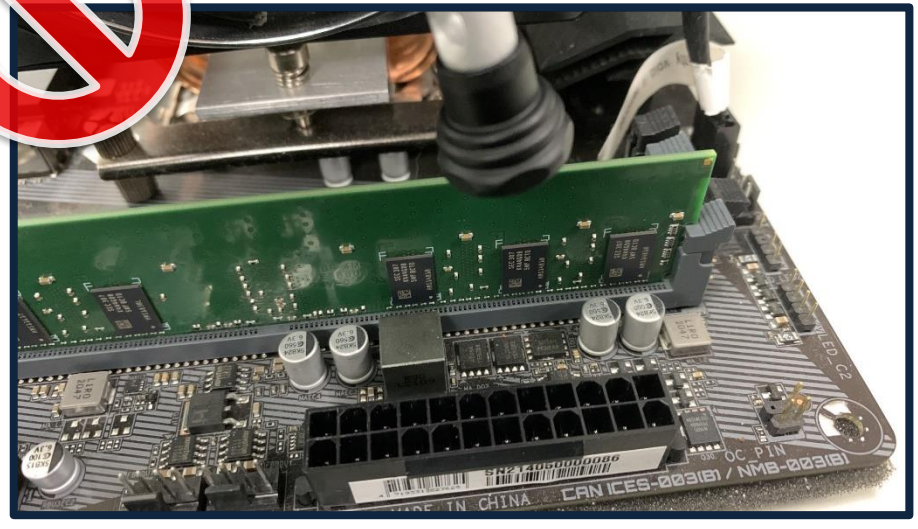


☐ **Do not insert key notch reverse.**

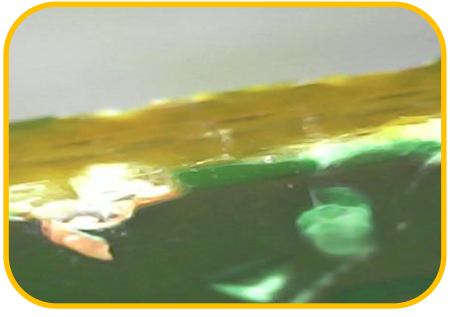
- PCB damaged / Side bend
- Gold Finger damaged



Wrong Handling



- **Damage Type :**



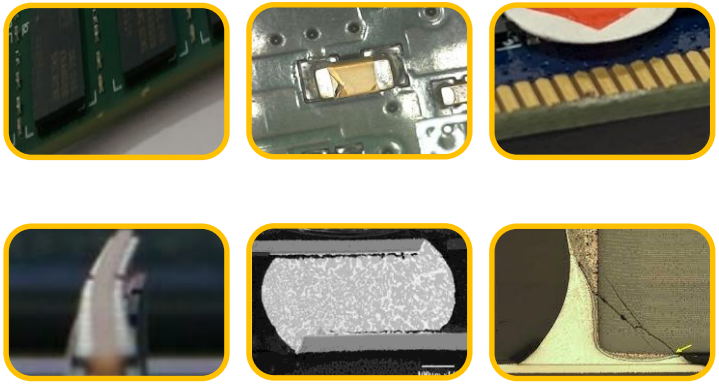
- **Do not use metal tools when the socketing.**

  - Collision damage
  - PCB damaged / Scratch
  - Unexpected force

- **Inappropriate striking force is almost equivalent to the Falling damage.**

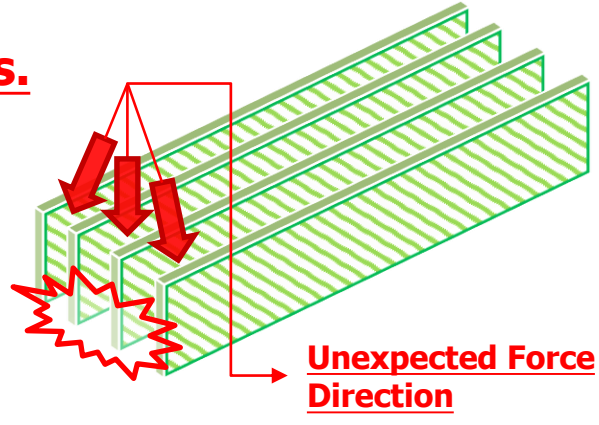
Wrong Handling

- **Damage Type :**



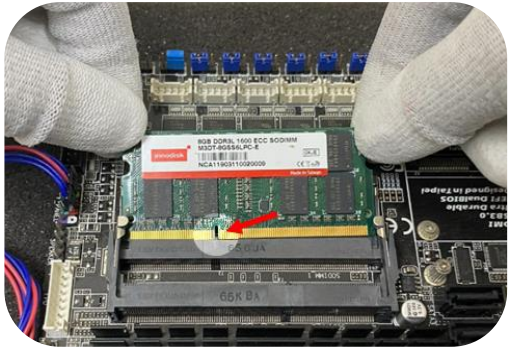
☐ Do not insert module between sockets.

- Twist damage
- Components internal damage
- PCB damaged / Bend
- Unexpected force

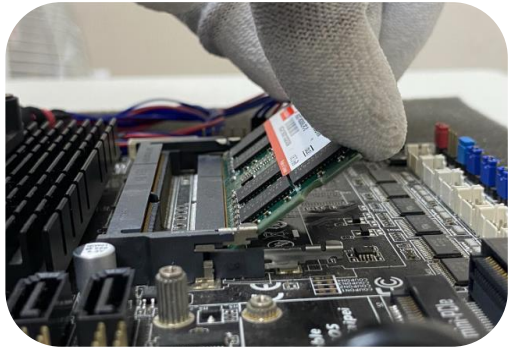


Proper Installation and Uninstallation Procedures

- **Proper Handling (Installation SODIMM)**

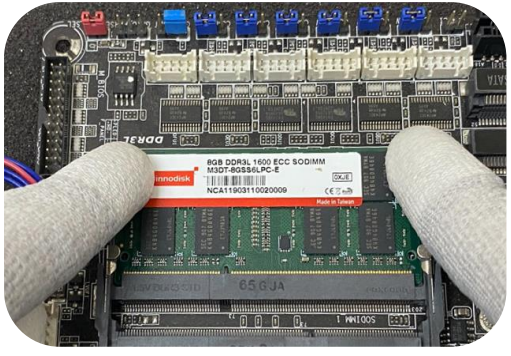


Align the module notch to the socket.



Hold both sides of the module and insert the module with about 30-degree angle.

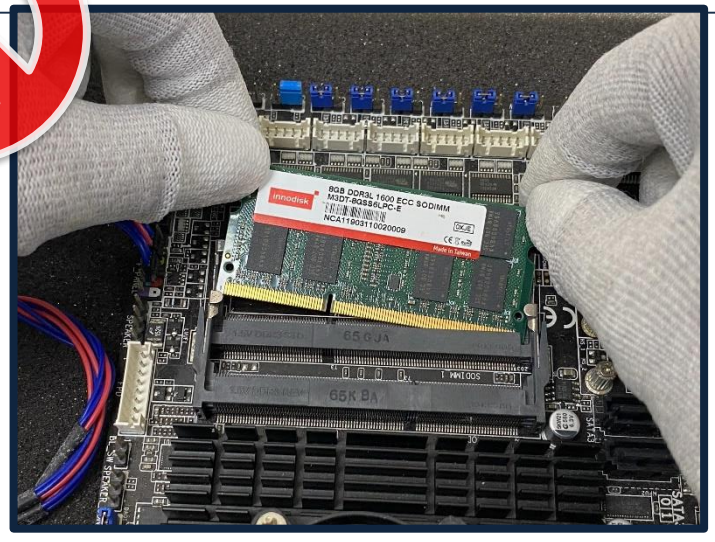
The angle may slightly vary depending on the connector specification.



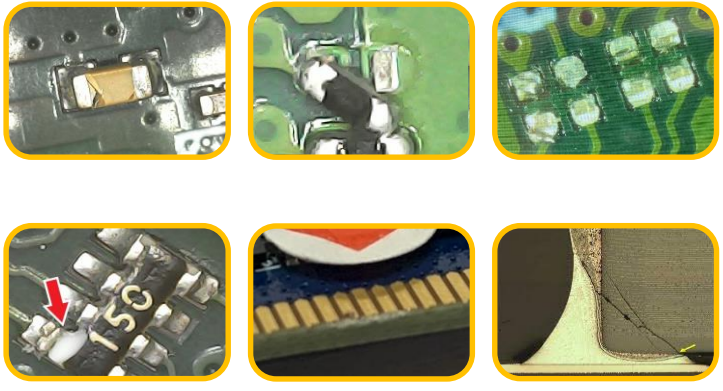
Make sure that the gold fingers are inside the socket.

Press the module at the both sides until the locking arms engaged with "click" sound.

Wrong Handling

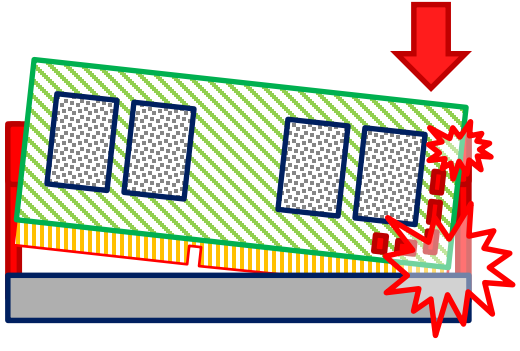


- **Damage Type :**

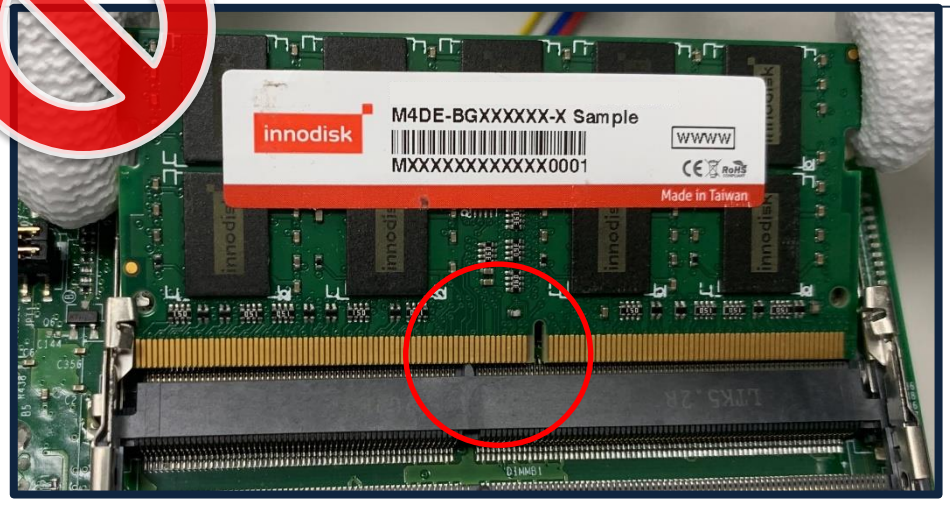


☐ Do not insert module Unevenly.

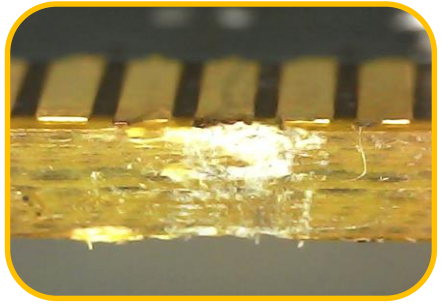
- Collision damage
- Side components crack
- Side components internal damage
- PCB damaged / Scratch
- Unexpected force



Wrong Handling

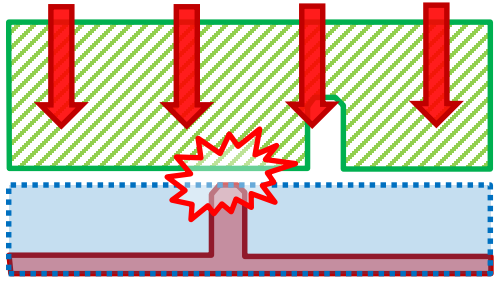


- **Damage Type :**

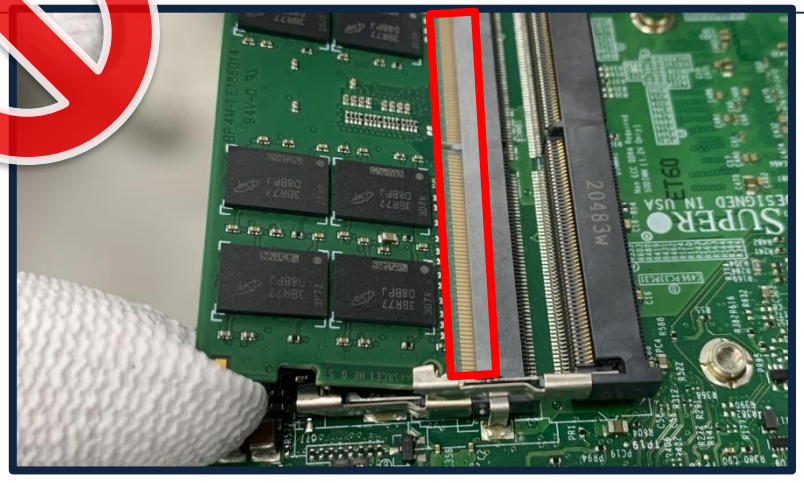


☐ **Do not insert key notch reverse.**

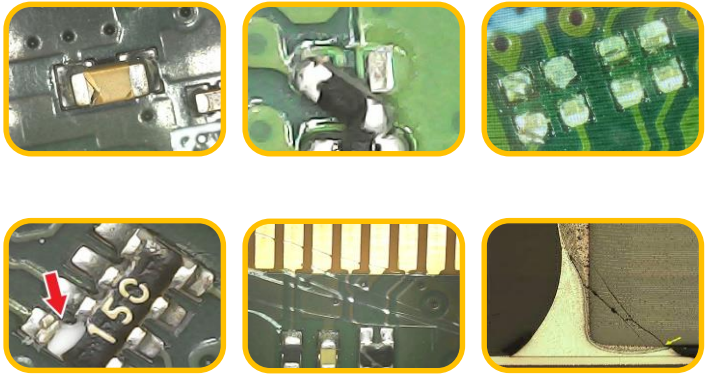
- PCB damaged / Side bend
- Gold Finger damaged



Wrong Handling

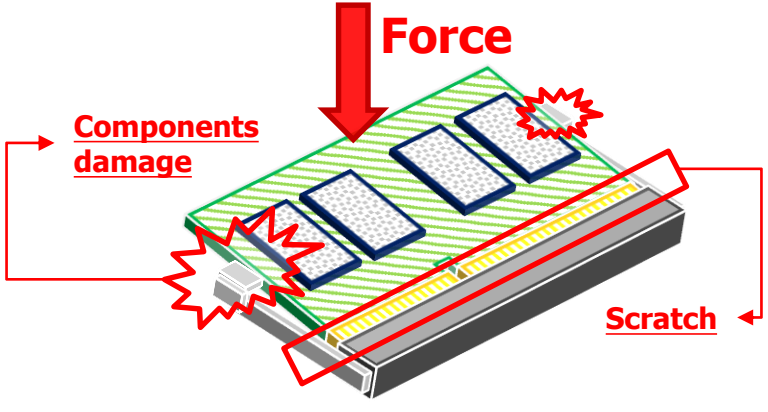


- **Damage Type :**



Do not press module before fully insert.

- Collision damage
- Side components crack
- Side components internal damage
- PCB damaged / Scratch
- Unexpected force



Wrong Handling

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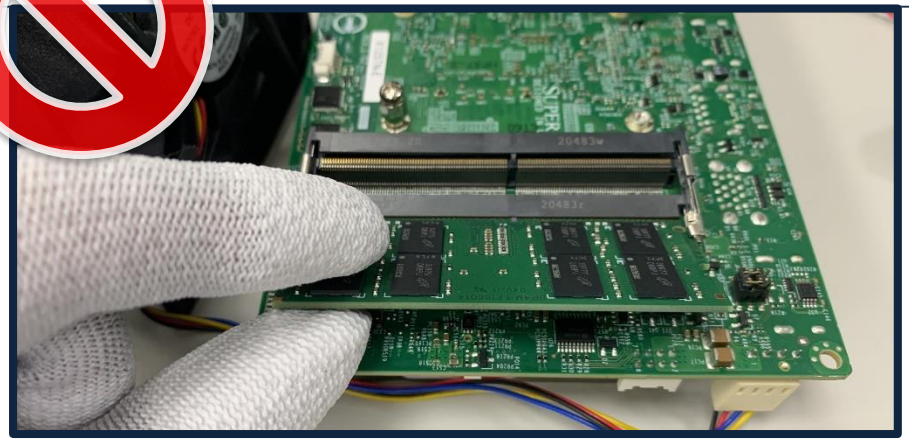
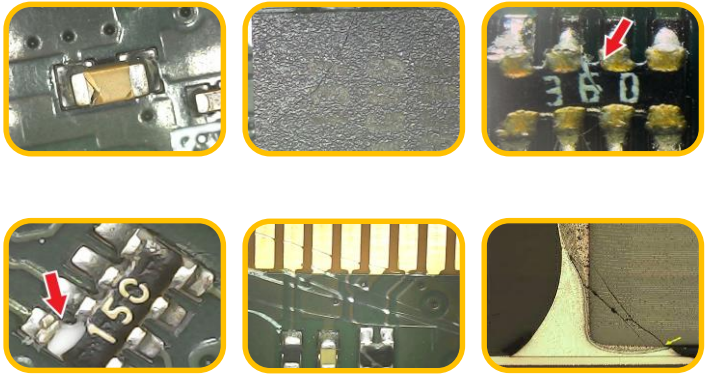
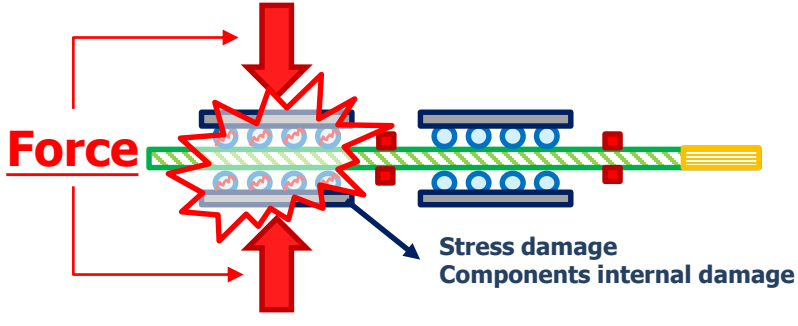


- **Damage Type :**

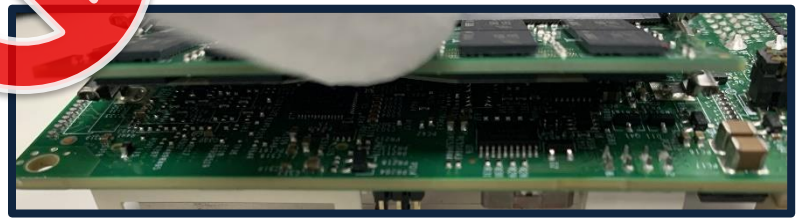


- **Please avoid direct contact with the components during any operations.**

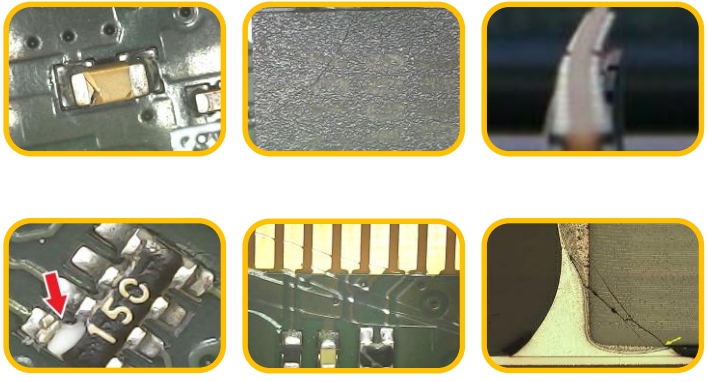
- Collision damage
- Components crack
- Components internal damage
- Unexpected PCB damaged
- Unexpected force



Wrong Handling

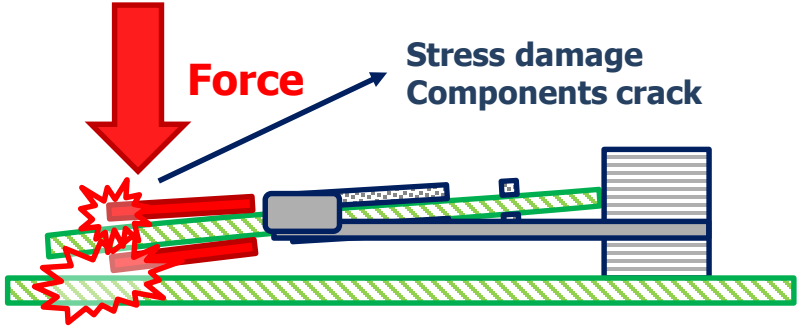


- **Damage Type :**



- **Do not use excessive force or too fast when inserting the module.**
- **Especially if the platform is designed to have components placed under the slot.**

  - Collision damage
  - Components crack
  - Components internal damage
  - PCB Bend / Scratch
  - Unexpected force



Wrong Handling

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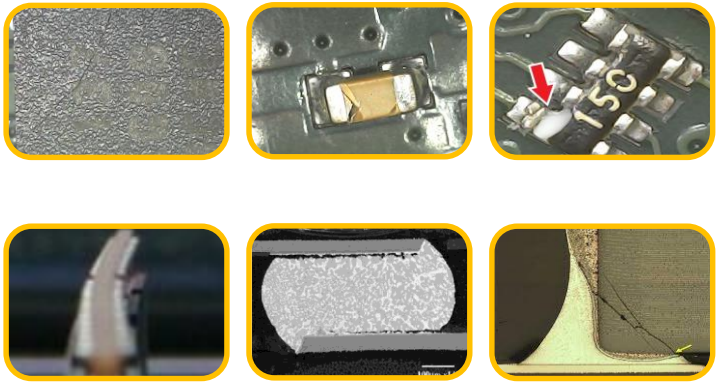
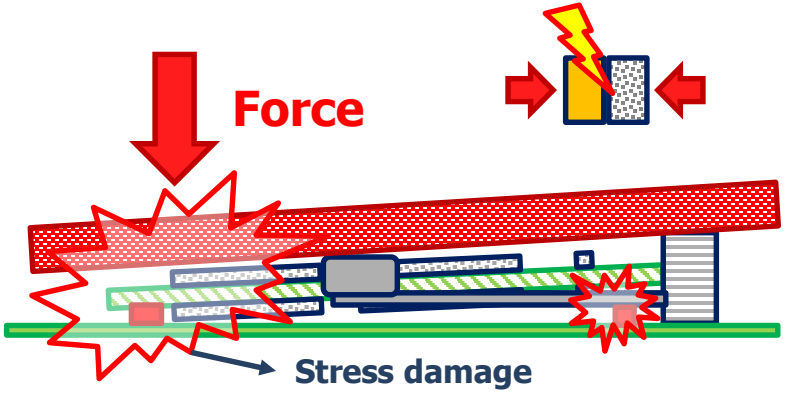
- **Please do not use any other objects to press the module during installation or use.**
- **The DRAM module is not design for pressing or buffering.**
  - Twist damage
  - Collision damage
  - Components internal damage
  - PCB damaged / Bend
  - Unexpected force
  - Unnecessary component contact
  - Short Circuit

- **Damage Type :**





Conclusion

- Through the information provided in this document, we hope that users have gained a clearer understanding of how improper operating practices can impact the normal operation of the product in different ways.

- Whether it involves affecting functionality or causing physical damage to the module, we aim to provide users with precise guidance to reduce the risk of product damage resulting from misunderstandings.

- Additionally, we intend to offer a direct path for improvement assessments.

Innodisk Corporation