Module Handling Guide Book

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hynix

Semiconductor

Contents

1. Introduction

1. Overview

- We have analyzed the causes of failure products for a long time. Most failure products are related with wrong handling and mechanical damages. Those causes can raise the problem like booting failure and wrong operation.
  As the technology of product develops, the sizes of Capacitor, MLCC, Resistor, EEPROM and passive elements are much smaller and thinner and their locations are placed on the edge of Module.
  Therefore, all of products must be handled very carefully to prevent damages.
  Especially, Registered DIMM which has a lot of elements is much fragile than any other product.
  Recently, FBGA product needs a lot of caution because FBGA type is made of ceramic which is weaker than TSOP type from external damages.
  Also, static electricity that could be produced by wrong handling is very important in Memory Module.
  If static electricity occurs, a critical failure happen to product. All products must be placed on area which is isolated from static electricity and operator always wear static-electricity proof gloves and shoes when handling the product.

- This guide book shows you a lot of failure cases when wrong handling and mechanical damage happen. These failure case are based on a lot of investigations and experiments for a long time. The main purpose is to reduce wrong handling and reinforce a process control in Hynix and to help customer keep their handling-circumstance safe.

1. Introduction

2. Understanding of memory module

Memory Module ..?

It is made by Many Memory IC's at the Printed Circuit Board

Register DIMM

Fully Buffered DIMM

Unbuffer DIMM

SODIMM

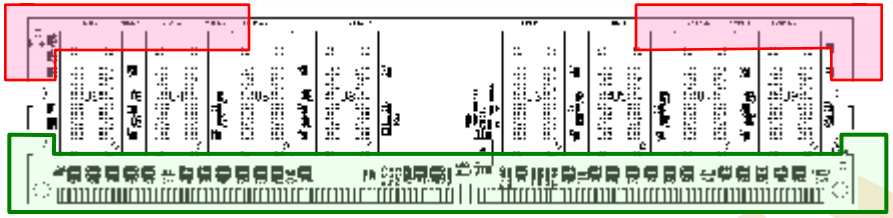
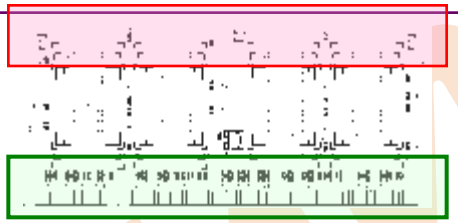
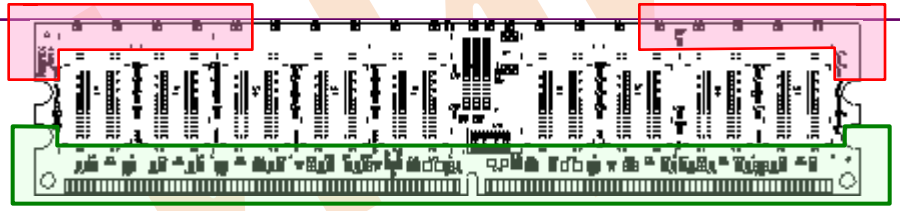
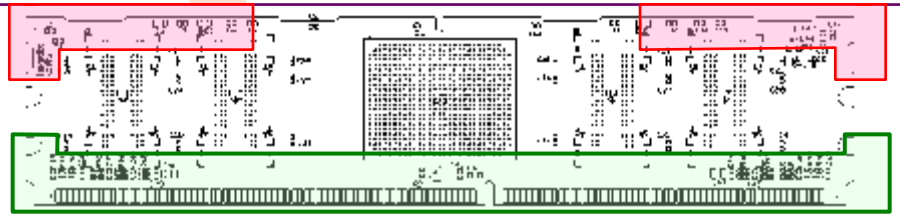
Server

Desktop

Notebook

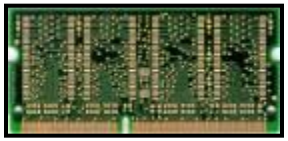
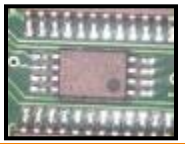
1. Introduction

3. Module Design Review

UB-DIMM (Un-Buffered DIMM)		: Weak Point (Component Crack, Damage) Major Cause is “Handling” : Weak Point (PCB Damage, Scratch). Major Cause is “Socket or Socket JIG”
SODIMM (Small Outline DIMM)		: Weak Point (Component Crack, Damage) Major Cause is “Handling” : Weak Point (PCB Damage, Scratch). Major Cause is “Socket or Socket JIG”
Reg-DIMM (Registered DIMM)		: Weak Point (Component Crack, Damage) Major Cause is “Handling” : Weak Point (PCB Damage, Scratch). Major Cause is “Socket or Socket JIG”
FB-DIMM (Fully Buffered DIMM)		: Weak Point (Component Crack, Damage) Major Cause is “Handling” : Weak Point (PCB Damage, Scratch). Major Cause is “Socket or Socket JIG”

1. Introduction

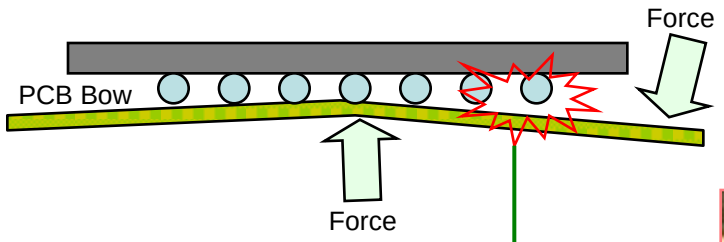
4. Memory module component Description

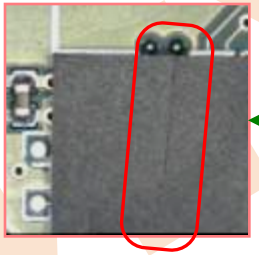
Component	Picture	Description
MLCC		MLCC is the abbreviation of “Multi layer Ceramic Capacitor”.
A/R		A/R is the abbreviation of “Array Resister”.
Chip Resister		C/R is the abbreviation of “Chip Resister”.
PCB		PCB is the abbreviation of “Print circuit board”.
EEPROM		EEPROM is the abbreviation of “Electrically erasable programmable read only memory”.

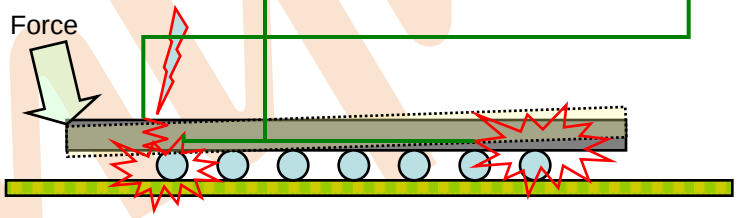
1. Introduction

5.DDR2 Vs. DDR3 Design (1/4)

DDR2 Package (FBGA Type)	DDR3 Package (FBGA Type)







Pressure on FBGA Package

➔ FBGA: Ball may not be operated as buffer

Weak Point

DDR2 And DDR3 Package is used same package type

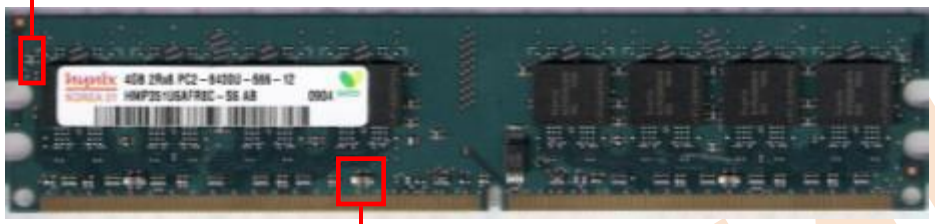
1. FBGA: Ball may not be operated as buffer
2. If pressure the edge of FBGA package, IC ball crack occur (No Support Point and the action of levers).
3. FBGA Package has weakness about PCB Bow and Twist.

1. Introduction

5.DDR2 Vs. DDR3 Design (2/4)

DDR2 UB-DIMM

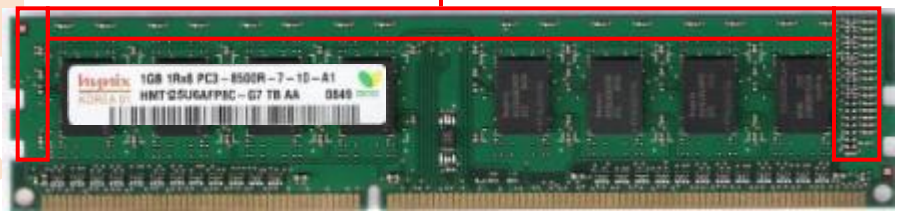
'0402' Type Cap
→ '0402' Type Cap is cracked easily as compared with "0603" Type Cap



'0805' Type Cap
→ As "0805" Cap height is higher than IC Height, "Cap" crack occur.

DDR3 UB-DIMM

'0402' Type Cap
→ '0402' Type Cap is cracked easily as compared with "0603" Type Cap
→ '0402'Type Cap is located the edge of module that is cracked easily by handling miss



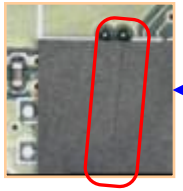
Weak Point

Difference of DDR2 Vs. DDR3 UB-DIMM
1. '0402' Type Cap is cracked easily on small pressure as compared with "0603" Type Cap.
2. As "0805" Cap height is higher than IC Height, "Cap" crack occur.

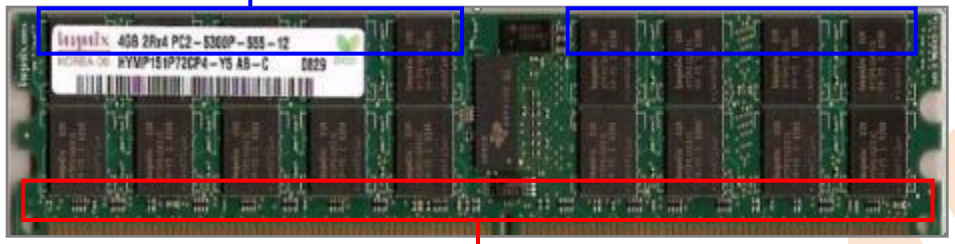
1. Introduction

5.DDR2 Vs. DDR3 Design (3/4)

DDR2 REG-DIMM



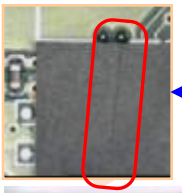
DRAM IC
→ DRAM IC of the top point is cracked easily by external damage



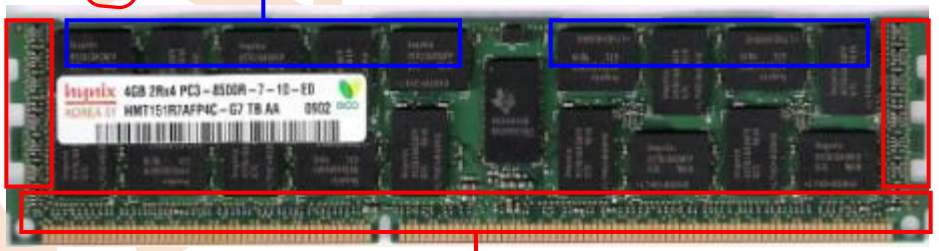
'0402' Type Cap.
→Small size capacitor is cracked easily

Cap Crack

DDR3 REG-DIMM



DRAM IC
→ DRAM IC of the top point is cracked easily by external damage

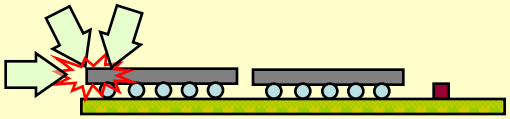


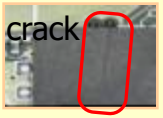
'0201' Type Cap
→ '0201'Type Cap is cracked easer than '0402'Type Cap

Weak Point

Difference of DDR2 Vs. DDR3 Reg-DIMM
1. DDR3 module has relatively high density of the edge point and component size is smaller than DDR2
2. '0201'Type Cap is smaller than '0402'Type Cap about 3 times

Sameness of DDR2 & DDR3 Reg-DIMM
1. DRAM IC is located the top point that is cracked easily by external damage or external pressure

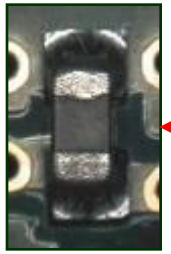




1. Introduction

5.DDR2 Vs. DDR3 Design (4/4)

DDR2 SO-DIMM	DDR3 SO-DIMM



'0402' Type Cap
→ '0402' Type Cap crack easy as compared with "0603" Type Cap

'0805' Type Cap
→As "0805" Cap height is higher than IC Height, "Cap" crack occur.

'0402' Type Cap
→ '0402' Type Cap is cracked easer than '0603' Type Cap
→ Cap of top area is cracked easily by external damage

Weak Point

Difference of DDR2 Vs. DDR3 SO-DIMM

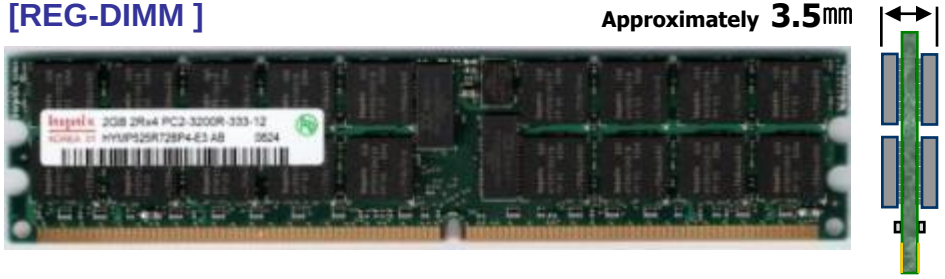
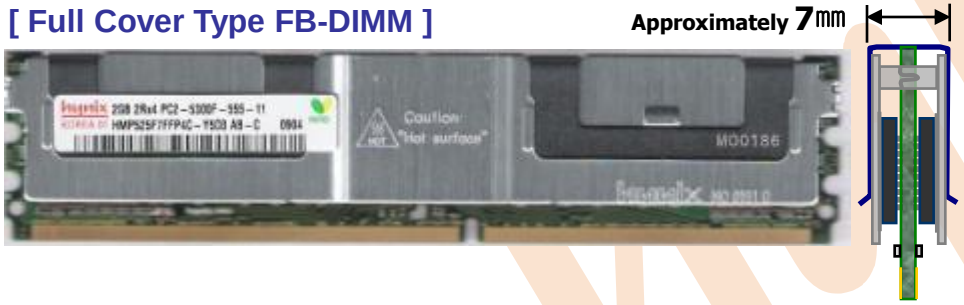
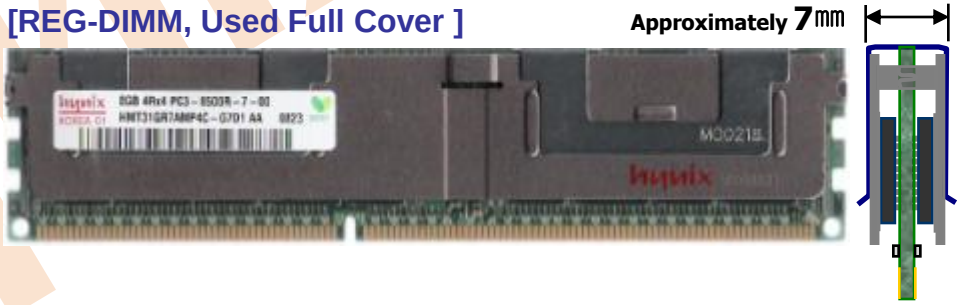
1. DDR3 SO-DIMM has more '0402'Type Cap than DDR2 SO-DIMM
2. DDR3 SO-DIMM has many '0402'Tye capacitors located top area and '0402'Type Cap crack occur more easily than DDR2 SO-DIMM

Sameness of DDR2 & DDR3 SO-DIMM

1. '0402' Type Cap crack easy on small pressure as compared with "0603" Type Cap.
2. As "0805" Cap height is higher than IC Height, "Cap" crack occur.

1. Introduction

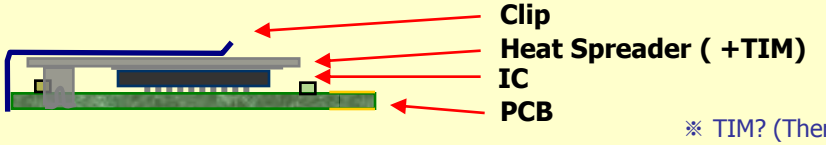
6.DDR2 REG-DIMM, FB-DIMM Vs. DDR3 REG-DIMM Design (1/1)

DDR2 REG-DIMM, FB-DIMM	DDR3 REG-DIMM
[REG-DIMM] Approximately 3.5㎜ 	[REG-DIMM, Unused Full Cover] Approximately 3.5㎜ 
[Full Cover Type FB-DIMM] Approximately 7㎜ 	[REG-DIMM, Used Full Cover] Approximately 7㎜ 

Weak Point

Difference of DDR2 REG-DIMM, FB-DIMM Vs. DDR3 REG-DIMM

1. FB-DIMM of DDR2 Modules is used Full Cover
2. Especial Module of DDR3 Modules is used Full Cover
   - ※ Module is used full cover that has relatively high Thickness and Weight heavier than normal module
   - ※ Structure



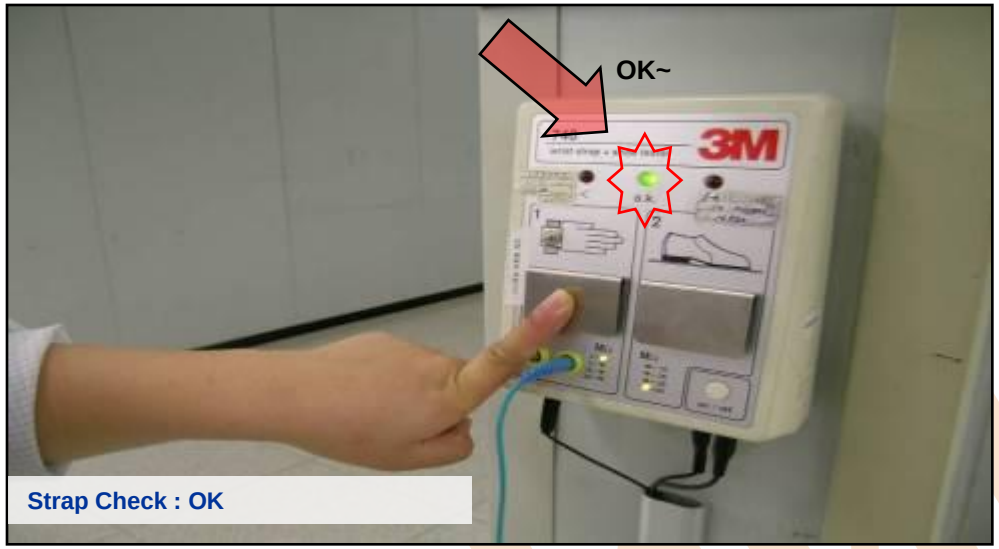
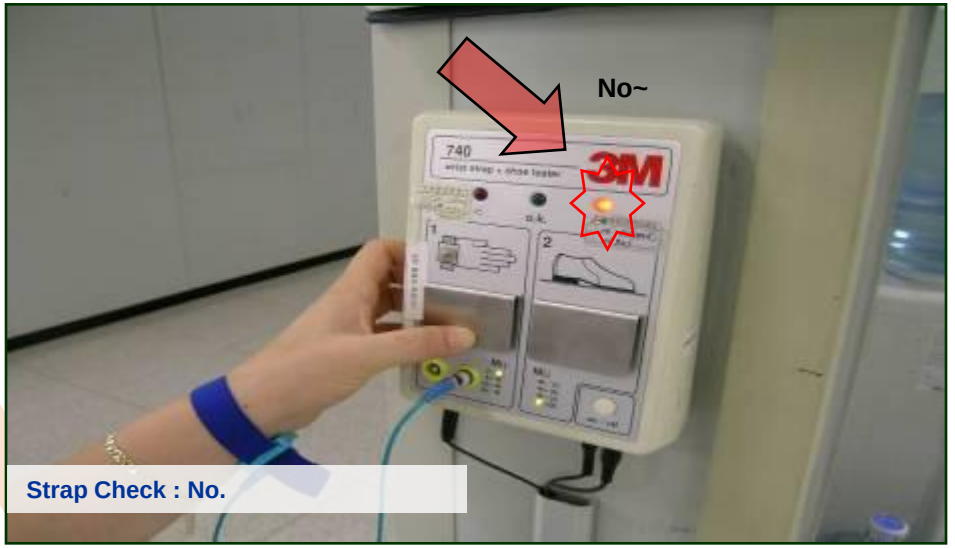
※ TIM? (Thermal Interface Material)

2. Module Handling Guide (Common)

Proper Handling	Wrong Handling
	

- “Anti-ESD Wrist Strap” Belt is contacted on Skin, Not Cloth Or Glove.

2. Module Handling Guide

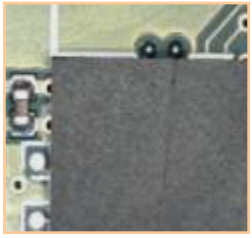
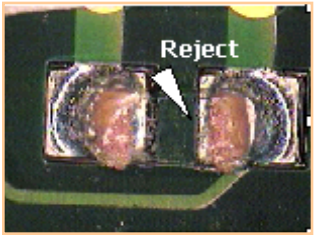
Proper Handling	Wrong Handling
	

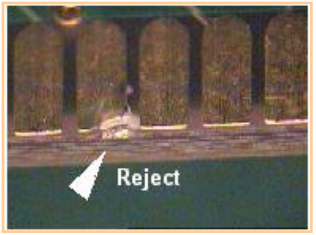
- “Anti-ESD Wrist Strap” should be Applied.
- When using Strap, You Must Check the “Strap”
- Ground your Strap at the Machine.

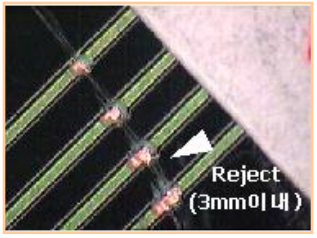
2. Module Handling Guide

Proper Handling	Wrong Handling
No Picture	

- Don’t Drop to the Floor.
- Reject mode : Component Crack, PCB Damage, Scratch Etc.



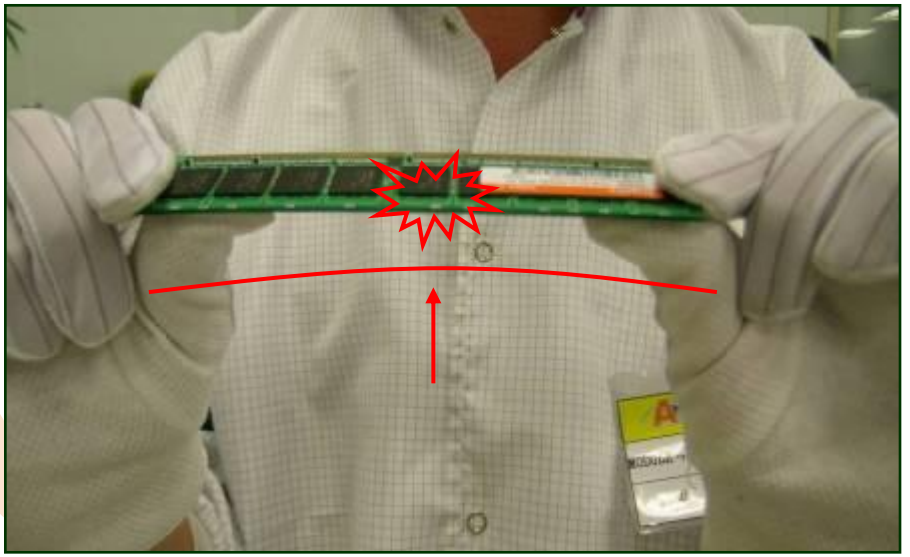


2. Module Handling Guide

Proper Handling	Wrong Handling
	
Product should be handled at Conductive Mat	Don’t Handle product at non-grounded Table

- All Product should be put at Anti-ESD Area.
- Product should be handled at Conductive Mat or Grounded Table.

2. Module Handling Guide

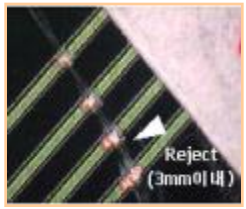
Proper Handling	Wrong Handling
No Picture	

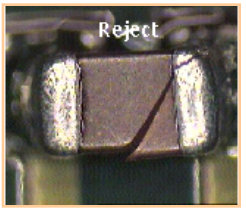
- Handling with care (To Prevent “PCB Bow”)
- Especially, FBGA type Product should be Handled with Care
- Reject mode : IC Ball Crack etc.

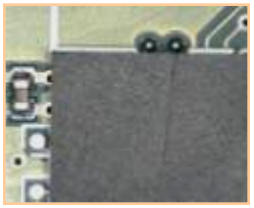
2. Module Handling Guide

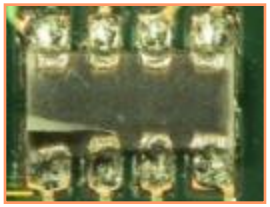
Proper Handling	Wrong Handling

- Don’t Grab Two Modules!! One Module Handling!!
- Reject mode : IC Crack, Component Crack, Tab Scratch etc.



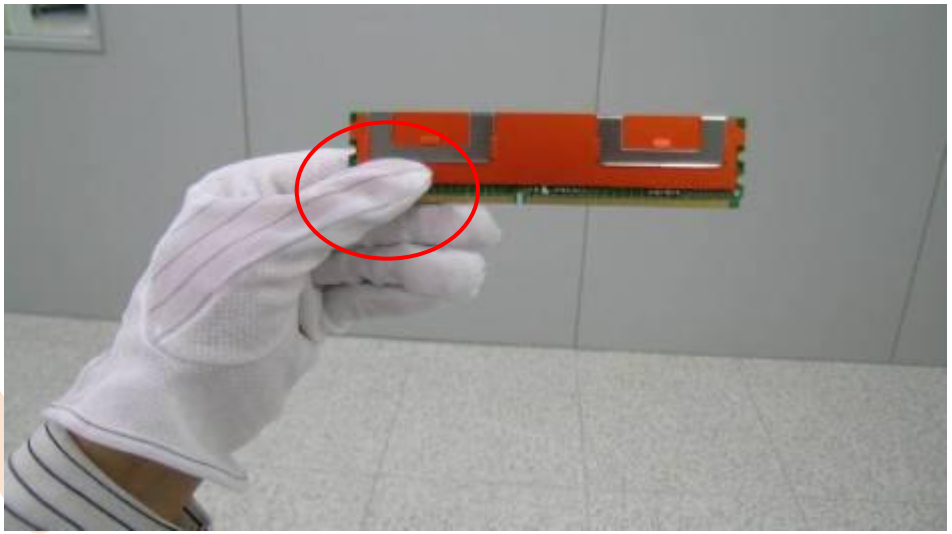




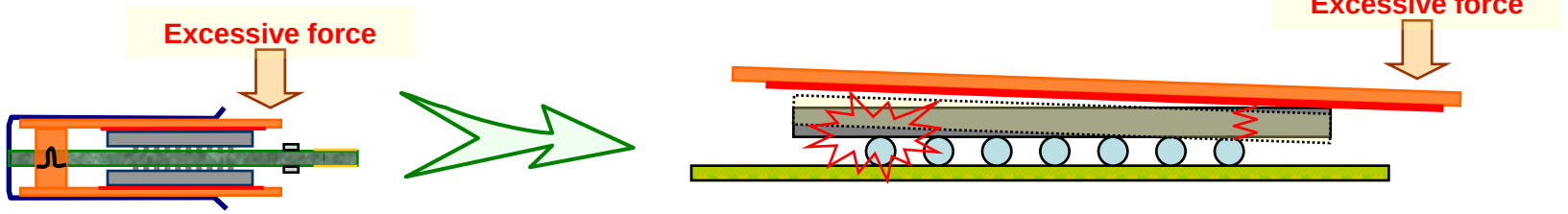


2. Module Handling Guide

Proper Handling	Wrong Handling



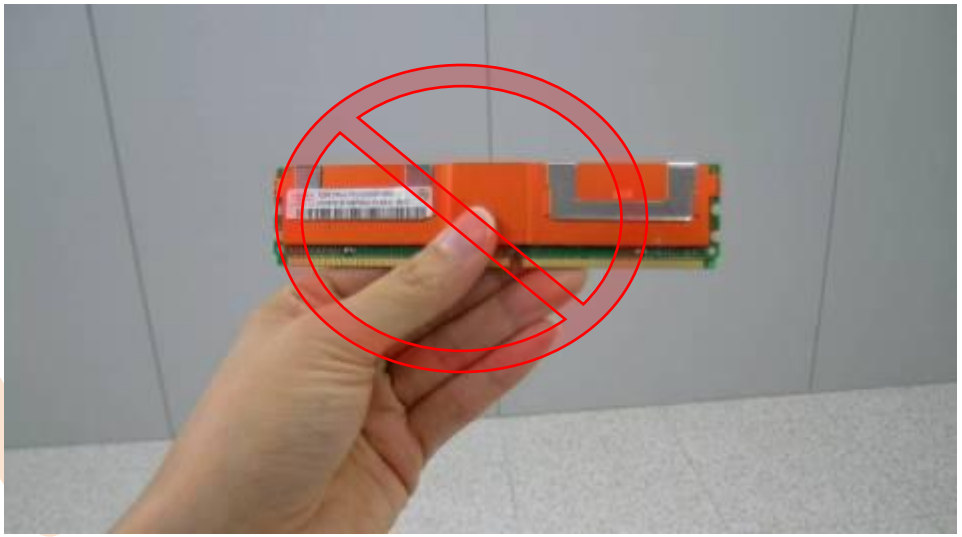
- Don’t Push the Edge of Heat Spreader



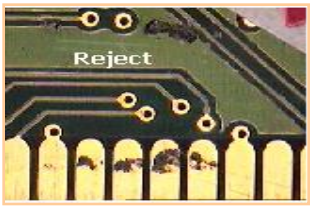
- Reject mode : IC Ball Crack, IC Body Crack etc.

2. Module Handling Guide

Proper Handling	Wrong Handling



- Don’t work on Naked Hands. Put on gloves !!
- Reject mode : Tab Contamination (Finger Print, Grease etc.)

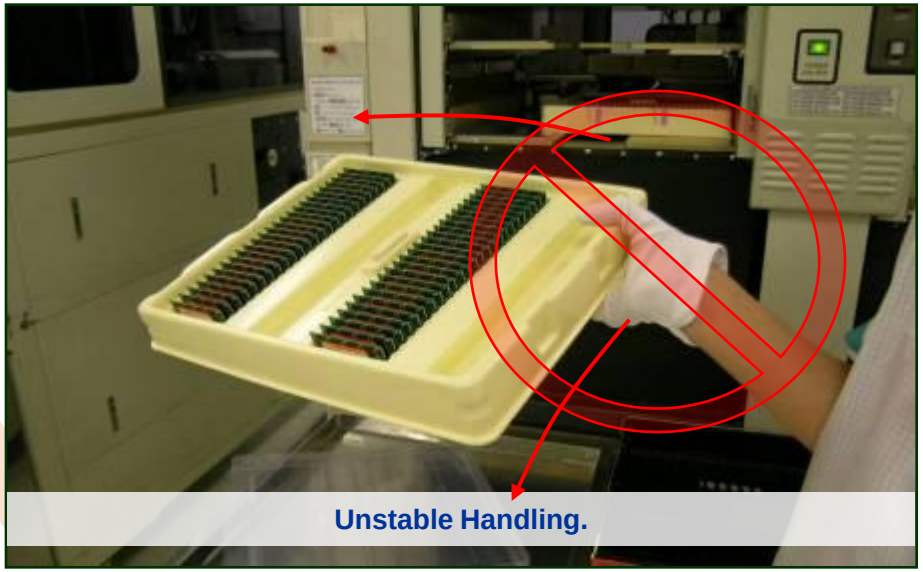


2. Module Handling Guide

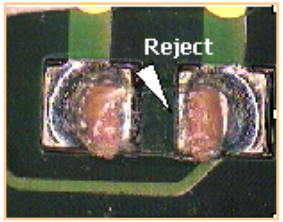
Proper Handling	Wrong Handling
No Picture	 

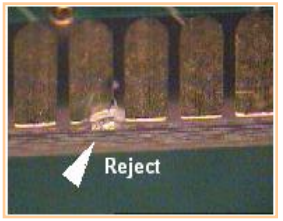
- Running System, Don’t Touch the Heat Spreader of FB-DIMM. (FB-DIMM)
- Because the Surface of Heat Spreader is “Very Hot”
- “Caution” - Be careful “Burn” !!

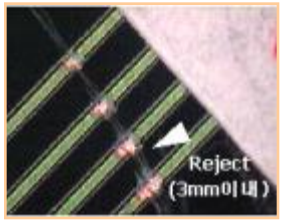
2. Module Handling Guide

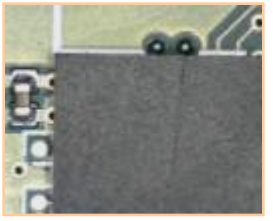
Proper Handling	Wrong Handling
	
Carrying Module Tray, you must move to hold a tray with both hands..	Unstable Handling.

- Carrying Module Tray, you must move to hold a tray with both hands.
- Don’t hold a tray with one hand. And Tray should be covered.
- Reject mode : Component Crack, PCB Damage.

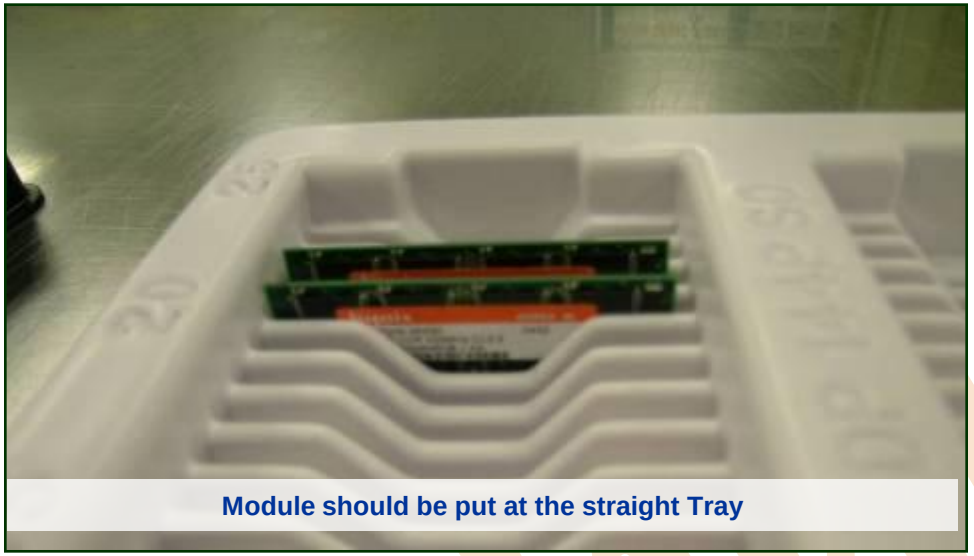


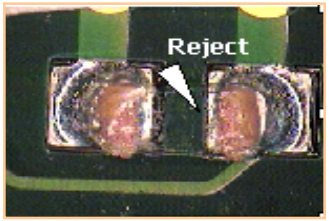




2. Module Handling Guide

Proper Handling	Wrong Handling
	
Module should be put at the straight Tray	If you use a wrong Tray, Product is damaged by falling or overlapping.

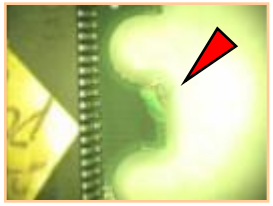
- Module should be put at the straight Tray.
- If you use a wrong Tray, Product is damaged by falling or overlapping.
- Reject mode : Component Crack etc.



2. Module Handling Guide

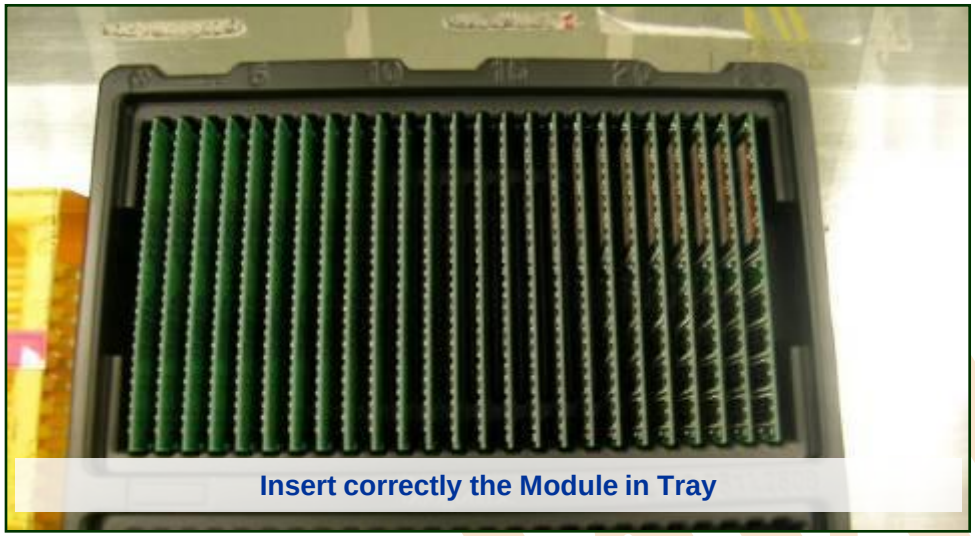
Proper Handling	Wrong Handling
	
Use with “Both hands”	Don’t insert with “One Hand” and Don’t insert on a tilt

- Inserting Module, We Use with “Both Hands”
- Don’t insert with “One Hand” and Don’t insert on a tilt
- Reject mode : PCB damage, Scratch etc.

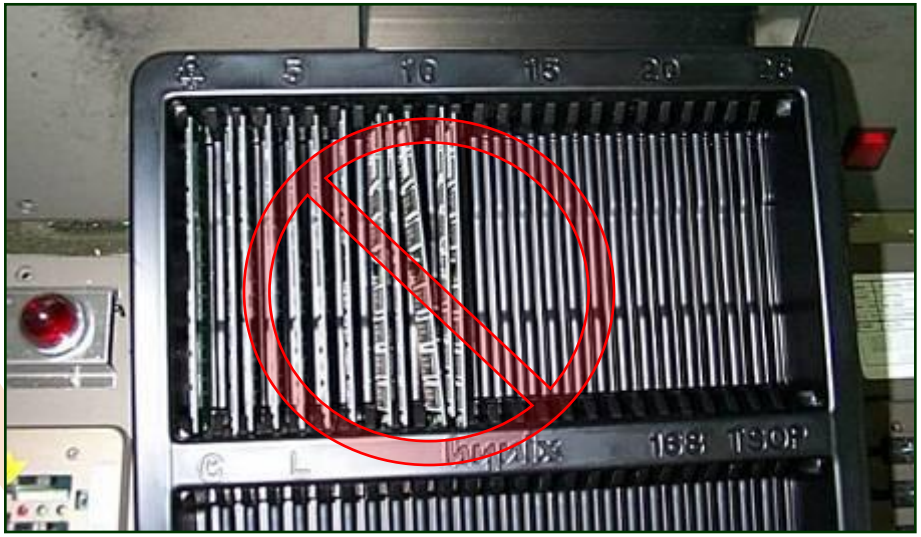



2. Module Handling Guide

Proper Handling	Wrong Handling

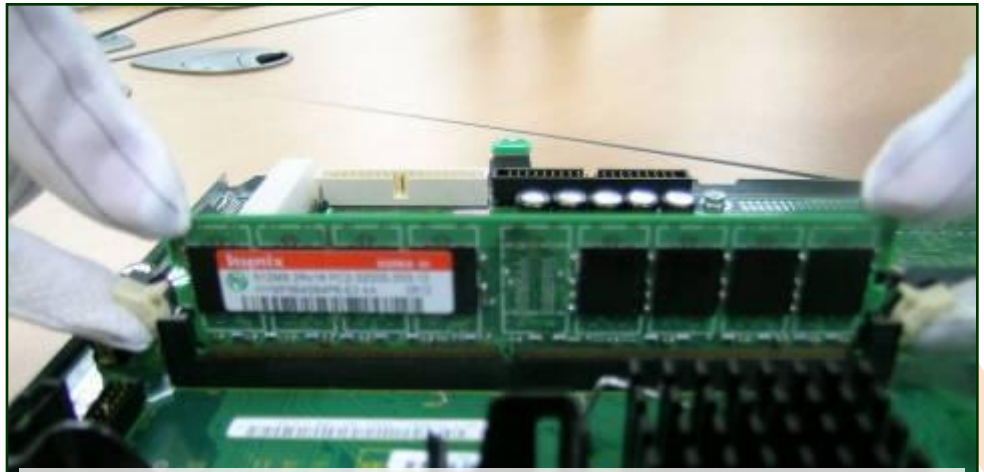


Insert correctly the Module in Tray

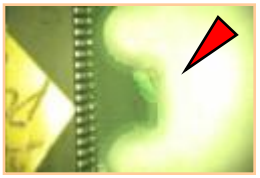


- When you insert the Module in Tray, You don't overlap the module with neighboring module.
- Reject mode : PCB damage, Component Crack etc.

2. Module Handling Guide

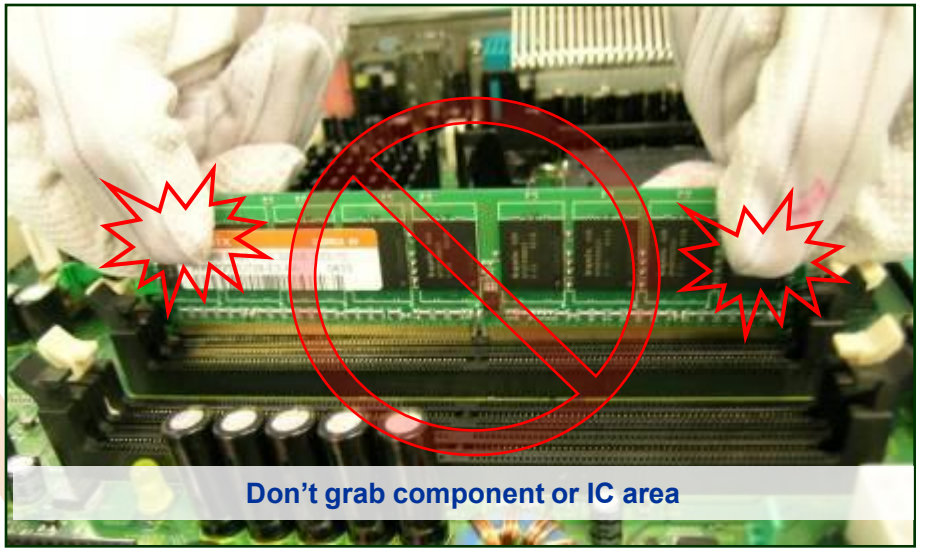
Proper Handling	Wrong Handling
	
You check to put straightly and then you insert the module.	Don’t put much pressure on a module when inserted.

- You check to put straightly and then you insert the module.
- Don’t put much pressure on a module when inserted.
- Reject mode : PCB Damage, Component Crack etc.




2. Module Handling Guide

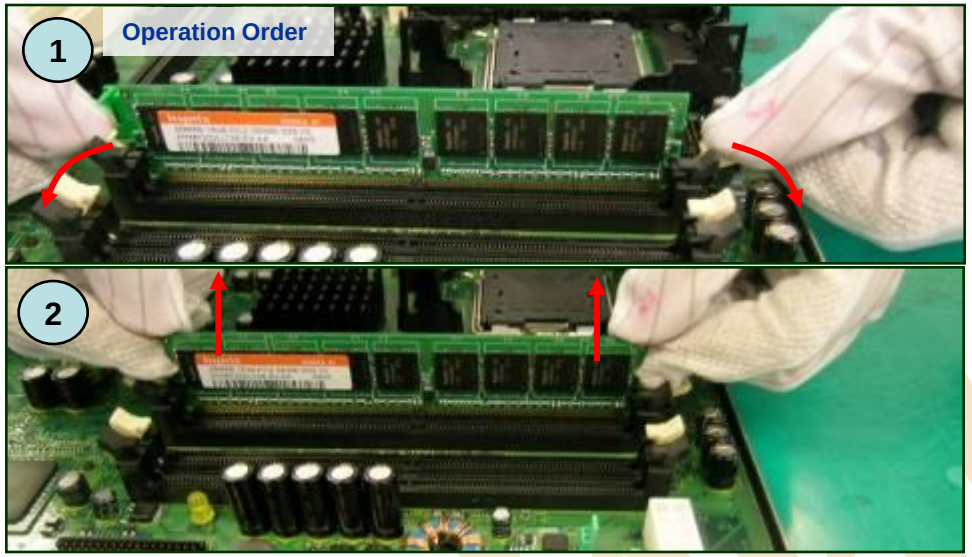
Proper Handling	Wrong Handling



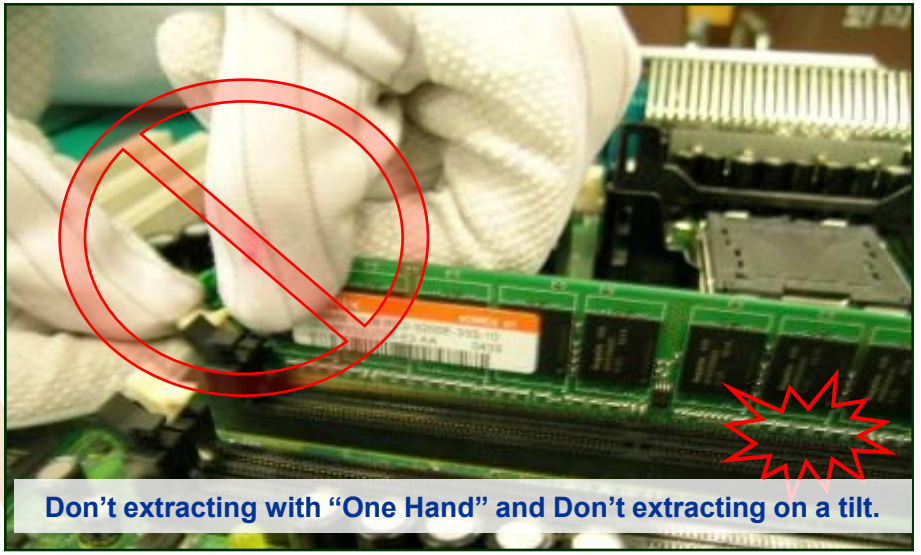
- When you insert FBGA Module, you don't grab component or IC area and you push top side.
  (Inserting Operation Order : ①Insert Module on Socket ②Push the Top side of PCB
  ③Hook side latch)
- Reject mode : IC Ball Crack, Component crack etc.

2. Module Handling Guide

Proper Handling

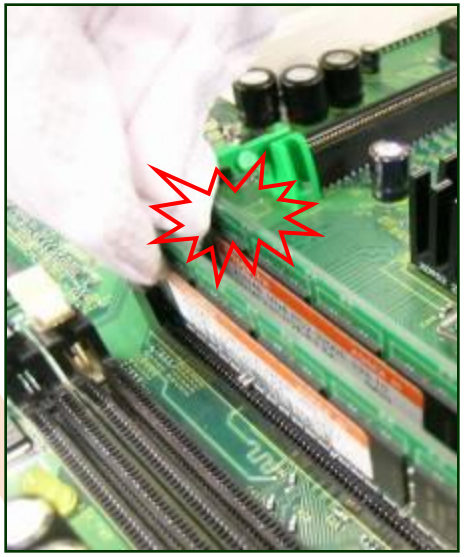
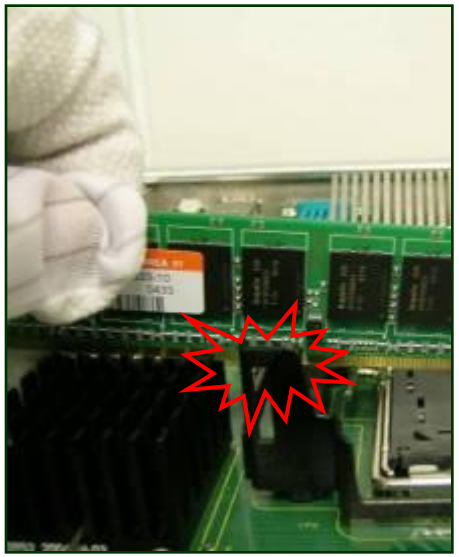


Wrong Handling

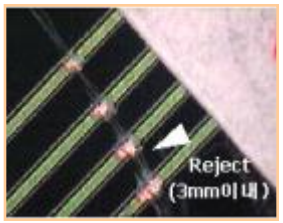


- Extract Operation Order : ①Unhook the Latch. ②Extract module in Socket
  (Attention : When unhooking the Latch, Module push slowly Latch not to Bound)
- Don’t extracting with “One Hand” and Don’t extracting on a tilt.
- Reject mode : IC Ball Crack, Tab Damage etc.

2. Module Handling Guide

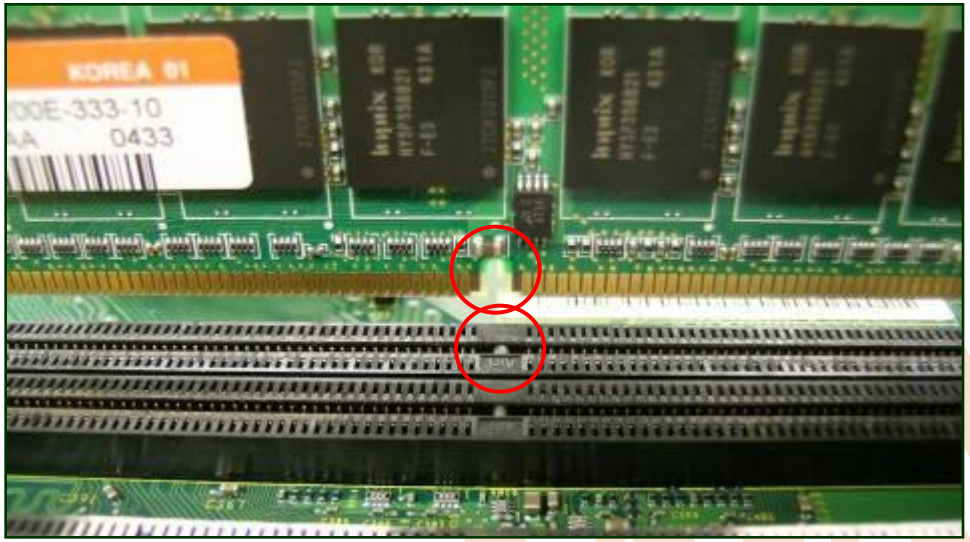
Proper Handling	Wrong Handling
No Picture	 

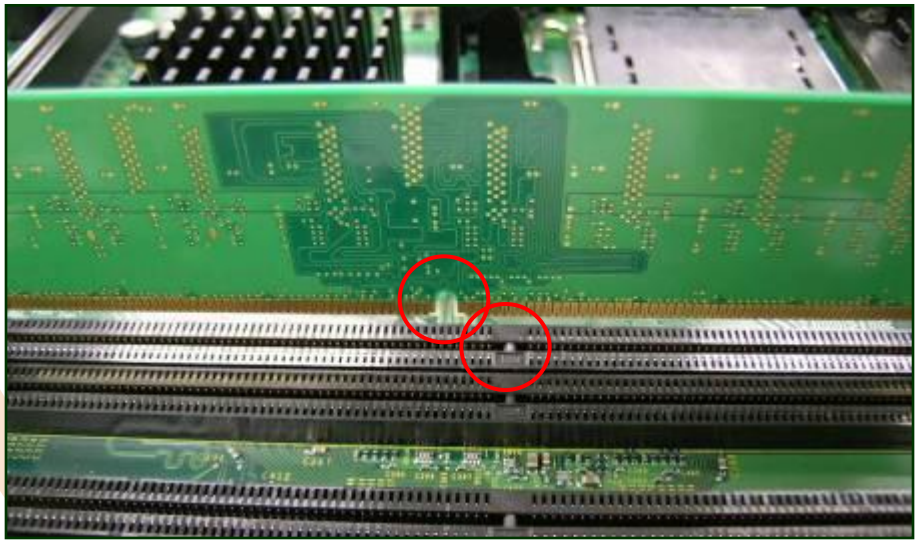
- Inserting/extracting Module, Be careful not to touch the neighboring module.
- Don’t drop module at Mother board and Be careful not to touch the neighboring component.
- Reject mode : Component Crack, Scratch, Damage etc.



2. Module Handling Guide

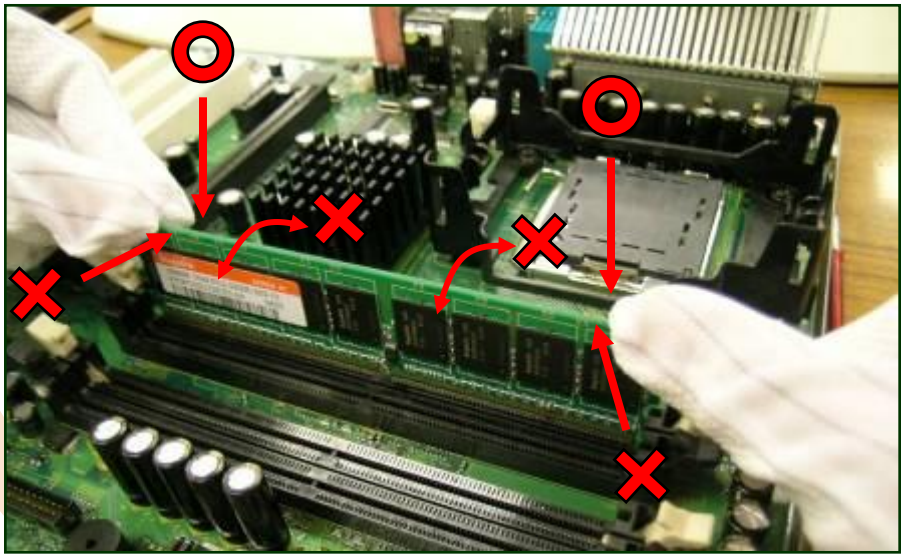
Proper Handling	Wrong Handling





- Inserting Module, Check the PCB notch position.
- Don’t put much pressure on a module when inserted.
- Reject mode : Tab Damage etc.

2. Module Handling Guide

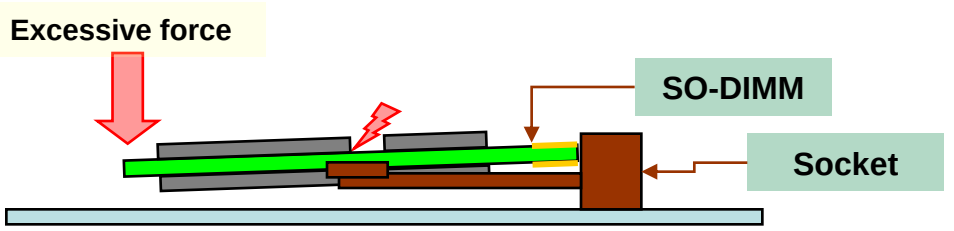
Proper Handling	Wrong Handling
No Picture	

- Inserting Module, Vertically Push the Module.
- Don’t Push Front and Don’t wave when Inserting/extracting.
- Reject mode : IC Ball Crack etc.

2. Module Handling Guide

Proper Handling	Wrong Handling

- After fully insert the module into the socket , Press it proper force.
  (※Caution!! Don't touch passive components on the module.)
- If insufficiently insert or excessively press the module into the socket, it has caused faults as below.
- Reject mode : IC Ball Crack, Tab Scratch



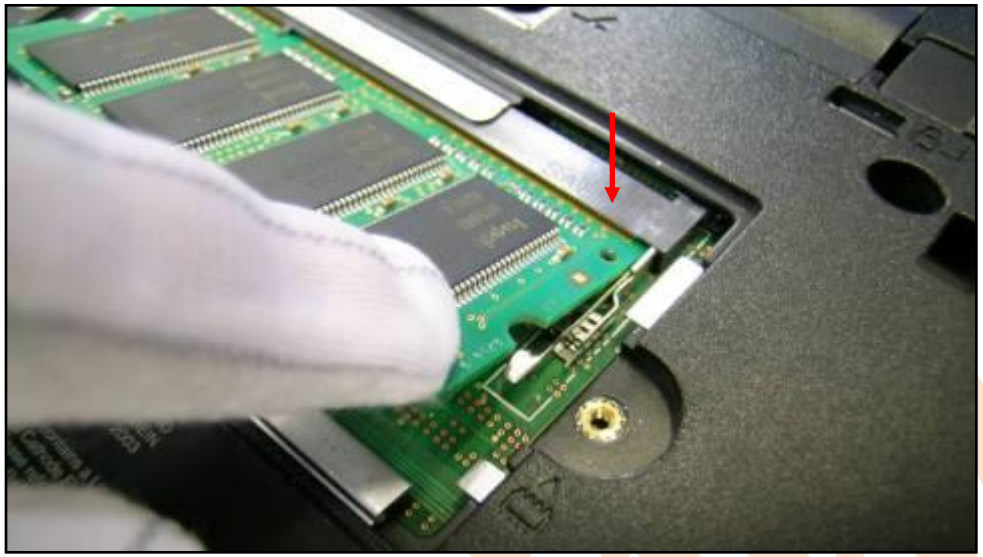
2. Module Handling Guide

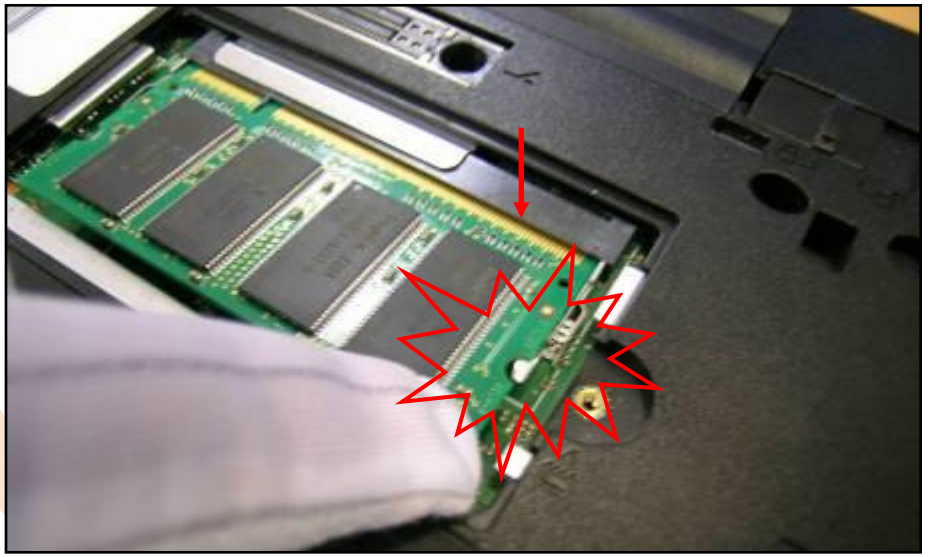
Proper Handling	Wrong Handling
No Picture	

- Inserting the Module, Be careful to be crashed into a projecting part.
- Before inserting the Module, check the PCB Notch position.
- Reject mode : IC Ball Crack, PCB Damage.


2. Module Handling Guide

Proper Handling	Wrong Handling

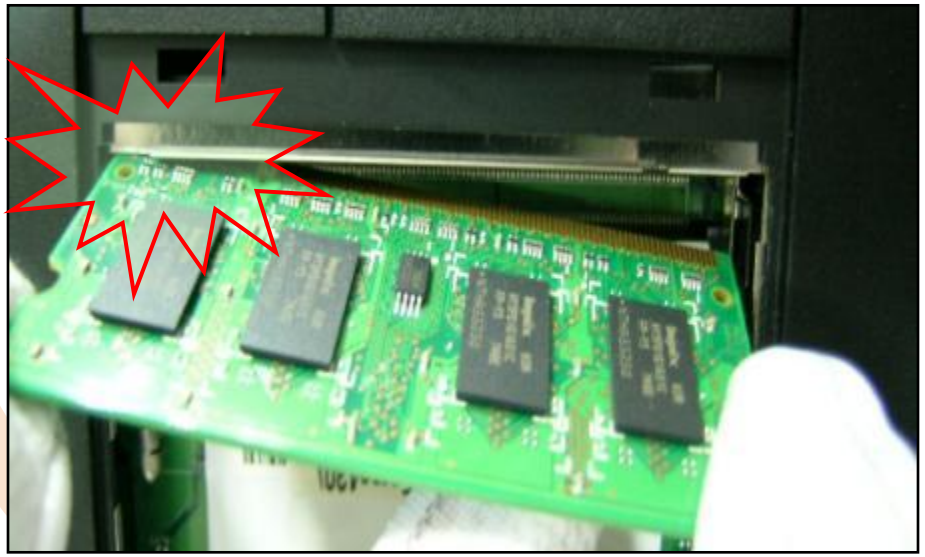




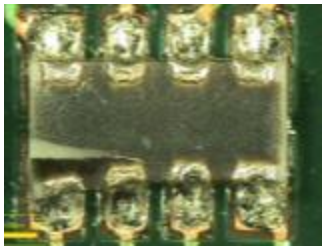
- Inserting Module, Be careful of PCB Notch damage.
- By Incompletely Inserting, Damage is Occurred
- Reject mode : PCB Notch Damage, IC Ball Crack.

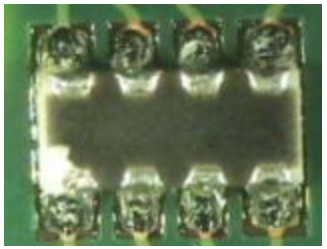
2. Module Handling Guide

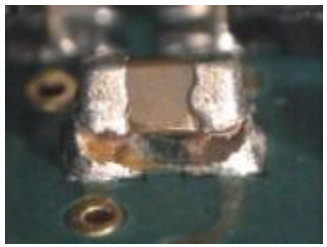
Proper Handling	Wrong Handling



- Inserting Module, Be careful of Component damage.
- Please Check The Module Alignment.
- Reject mode : Component Crack.

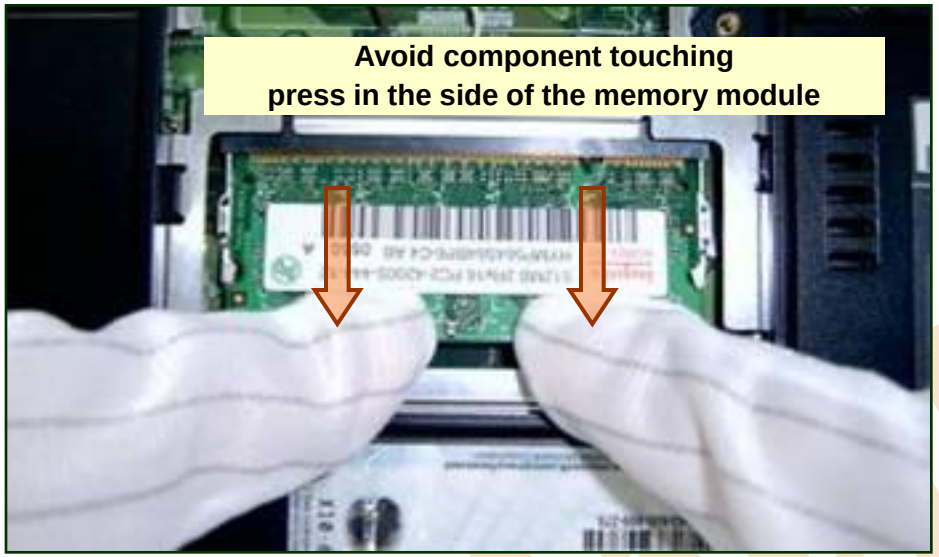




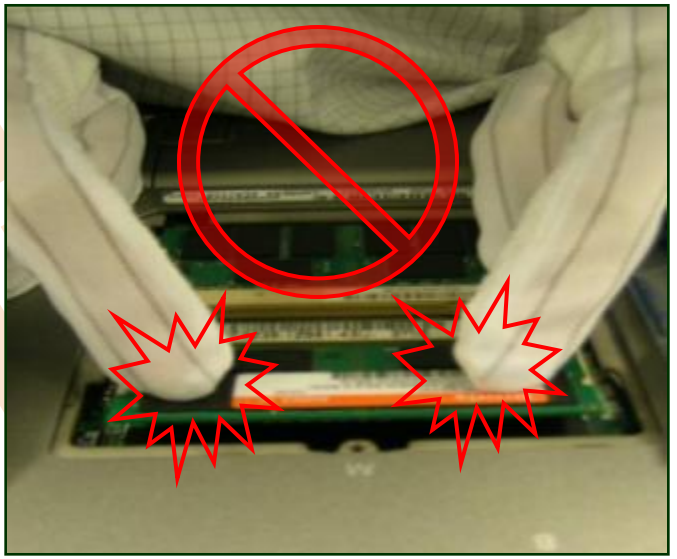


2. Module Handling Guide

Proper Handling



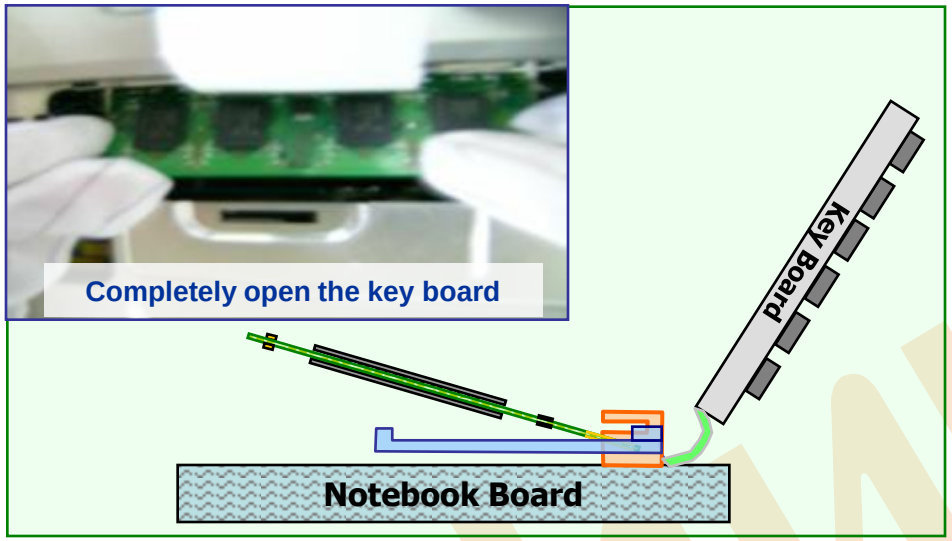
Wrong Handling



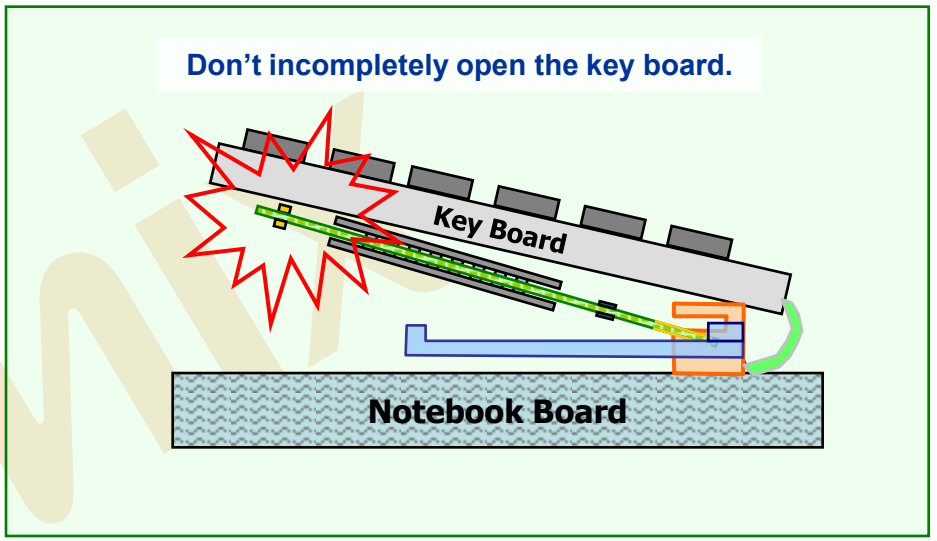
- When You Insert The Memory Module, Be careful of FBGA ICs or Component damage.
- Please Avoid component touching and press in the side of the memory module.
- Reject mode : IC Ball Crack, Component Crack.

2. Module Handling Guide

Proper Handling



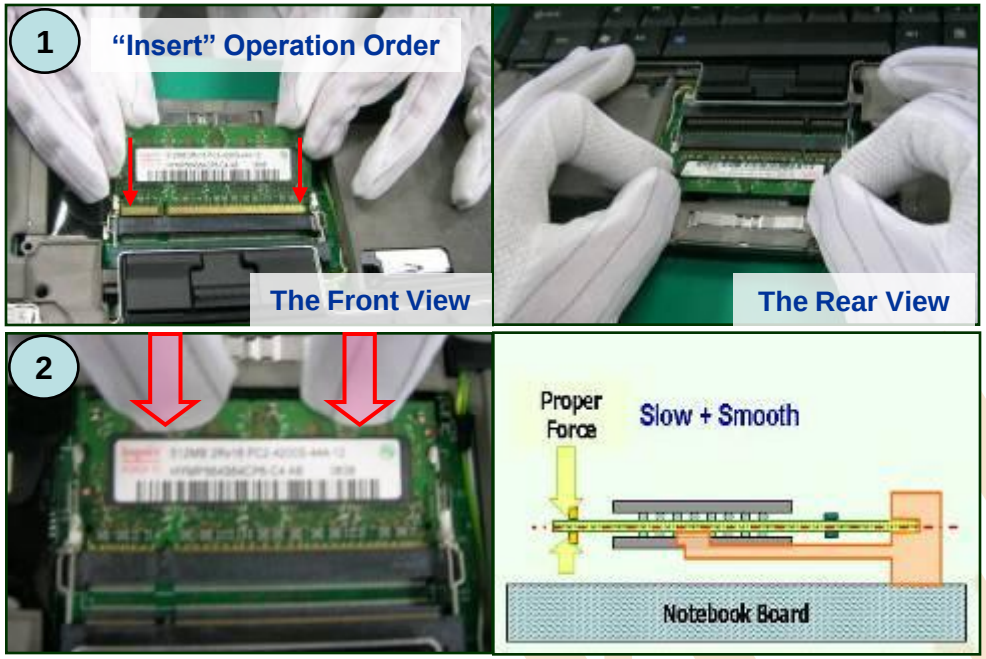
Wrong Handling



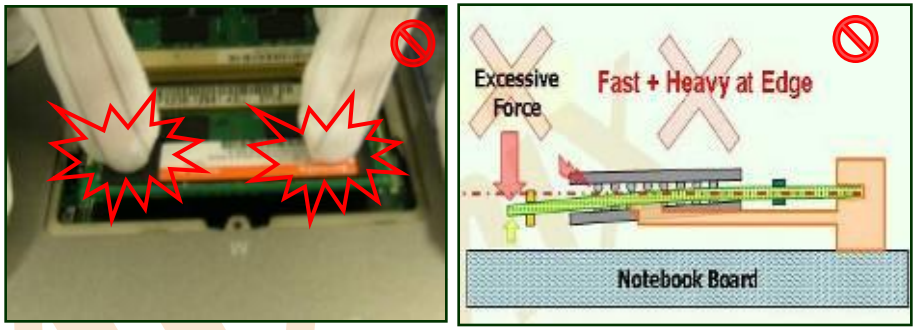
- If the socket is located in the key-board, Completely open the key-board.
- And carefully insert the module.
- Reject mode : IC & Component Crack

2. Module Handling Guide

Proper Handling



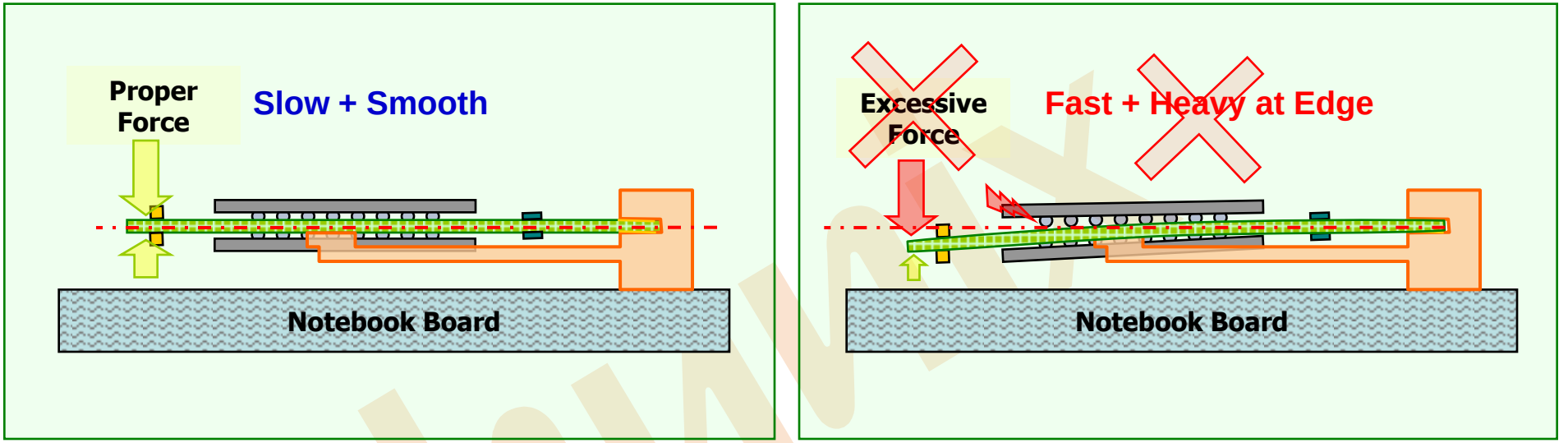
Wrong Handling



- "Insert" Operation Order : ① Insert Module in Socket with an inclination of 45 degrees.
  ② Avoid component touching and Press in the side of the module.
- When you insert FBGA Module, you don't grab component or IC area and you push top side.
- Please, Press a Module with the Proper Force. ("Slow & Smooth")
- Reject mode : IC Ball Crack, Tab Damage etc.

2. Module Handling Guide

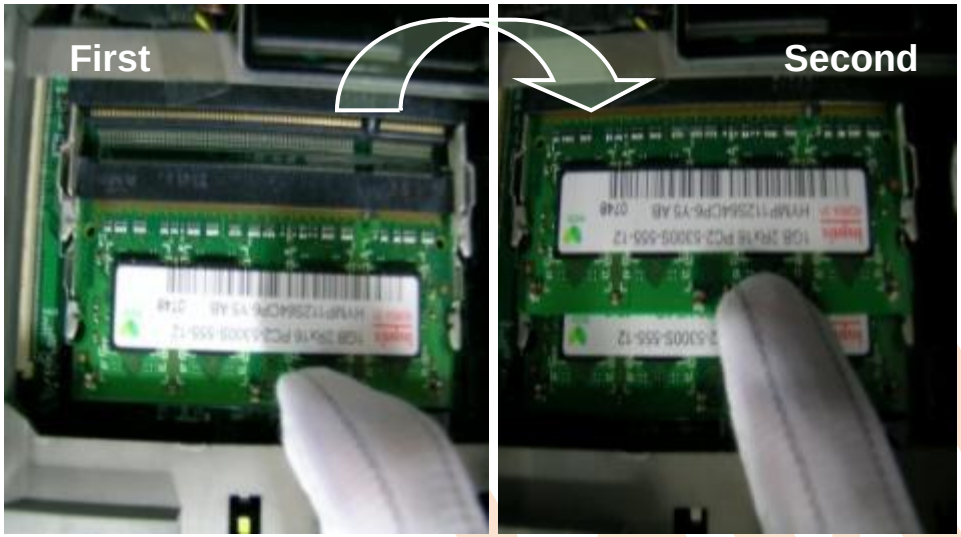
Proper Handling	Wrong Handling



- Solder Joint Crack Fail Mechanism due to heavily press
- Please, Press a Module with the Proper Force.
- Reject mode : IC Ball Crack, Component Crack.

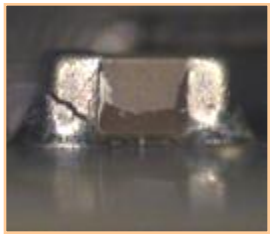
2. Module Handling Guide

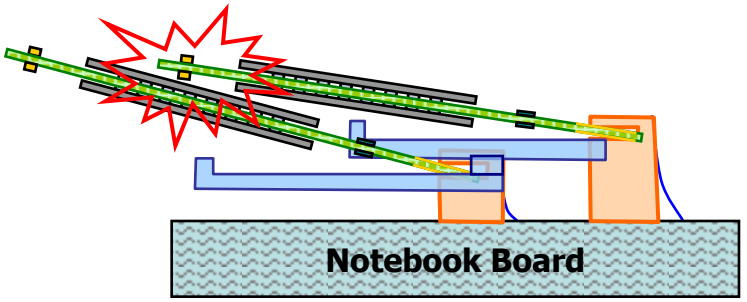
Proper Handling



Wrong Handling

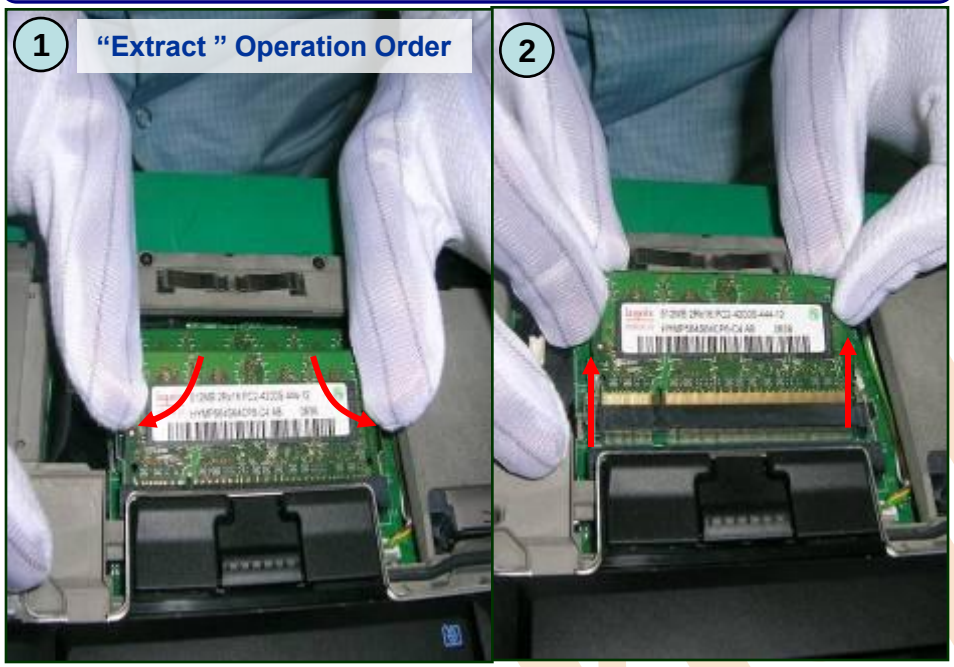
- After Completely Inserting the Module at the lower socket, Insert the next Module
- Pleas, Don't insert two Modules at the same time
- Reject mode : IC Ball Crack, Component Crack etc.



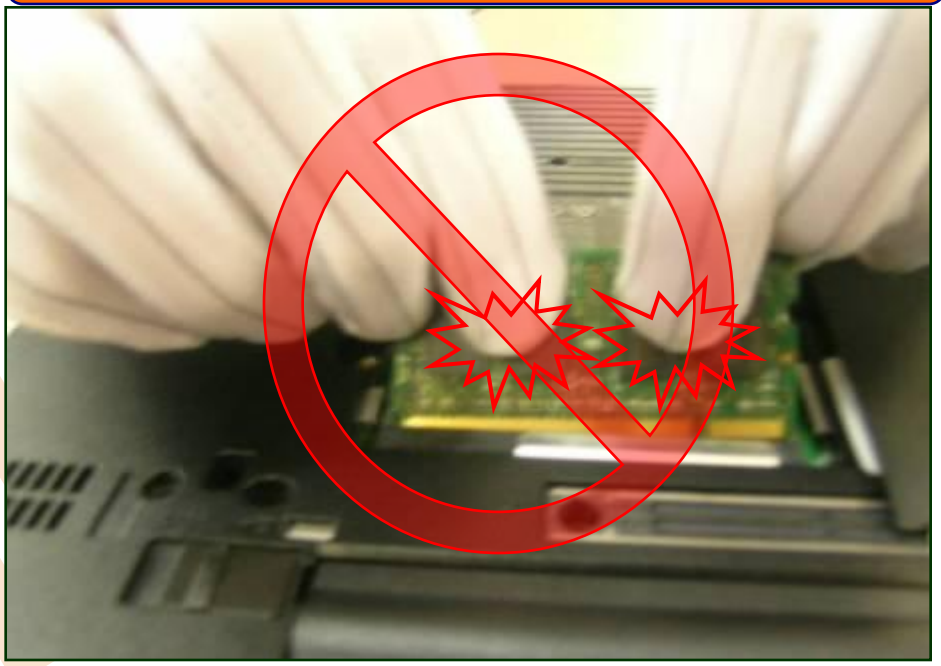


2. Module Handling Guide

Proper Handling



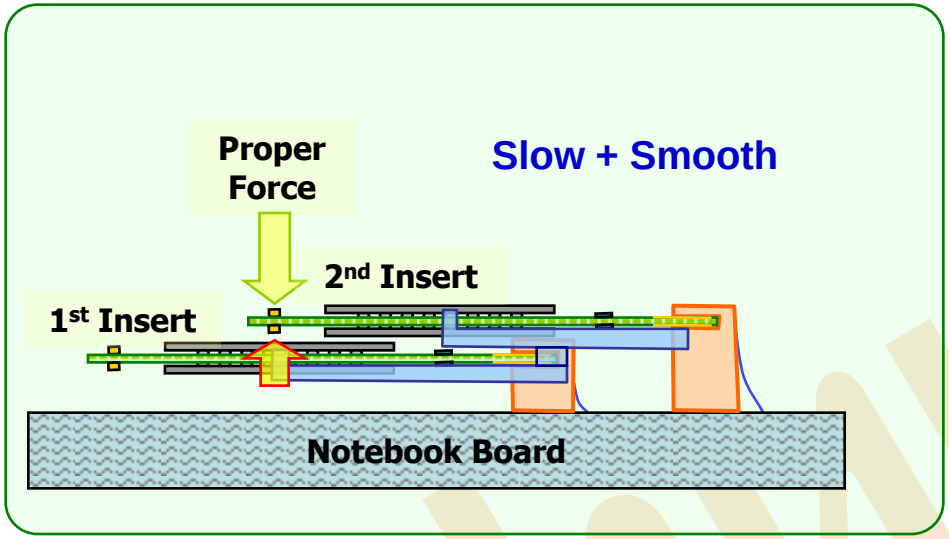
Wrong Handling

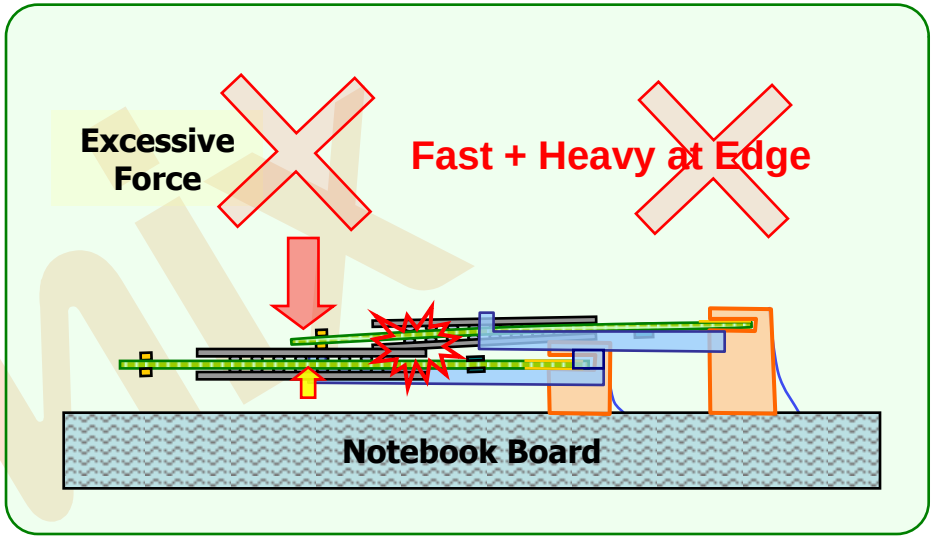


- “Extract” Operation Order : ①Unhook the Latch.
  ②Extract module in Socket with an inclination of 45 degrees.
- When you extract FBGA Module, you don’t grab component or IC area.
- Reject mode : IC Ball Crack etc.

2. Module Handling Guide

Proper Handling	Wrong Handling

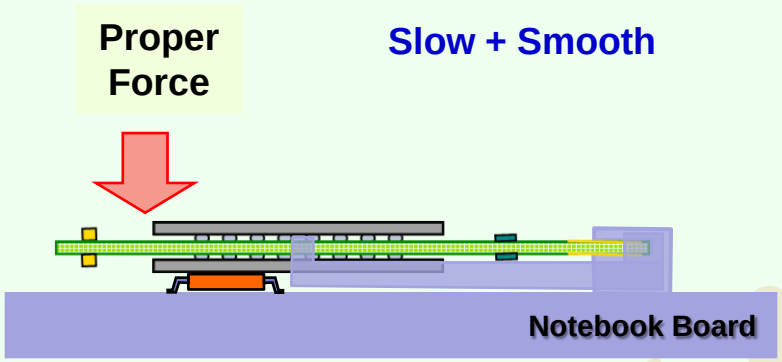




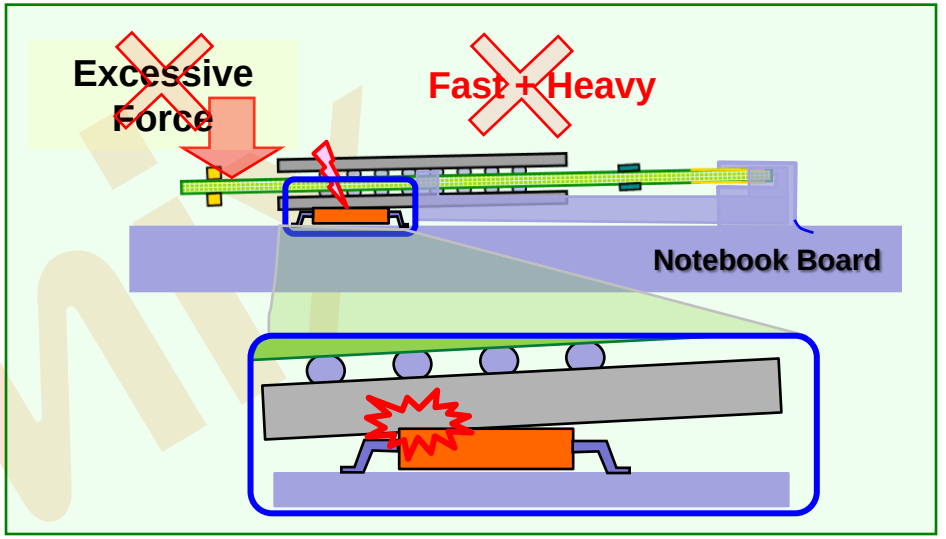
- Be Careful !! Don’t Press Module by excessive force
- Don’t strike Module against the lower Module

2. Module Handling Guide

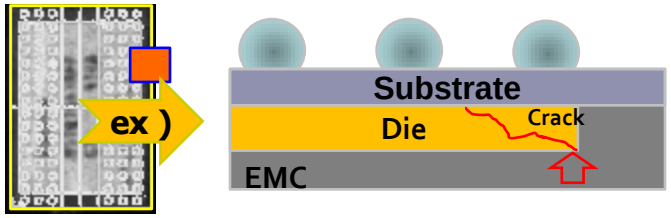
Proper Handling



Wrong Handling



- Carefully insert the module into the socket .
- Please, Press the module with the proper force..
- If not, inner chip crack will be occurred on the bottom side.
- Reject mode : IC [inner chip] Crack



Red circle area is damage source

ex) Socket image