

# USER'S MANUAL

## (Chip Scale Package)

- *To make a win-win situation for CSP products supplier and customer, Samsung provides the information of CSP package's characteristics and manuals to maintain high quality so that the problems of customer process can be minimized or prevented*
- *Samsung will support the technical information when customer's request it.*

Written by Module team .(FEB.2007,Rev.03)

Revised by Device Packaging technology team (FEB.2007, Rev.04)

It says understanding of CSP package, general handling method(box moving, tray, reel, module PCB), defect mode in mounting process(chip crack, cleaning, repair, solder joint reliability) and visual inspection criteria

## 1. Understanding of CSP

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## 4. Inspection criteria

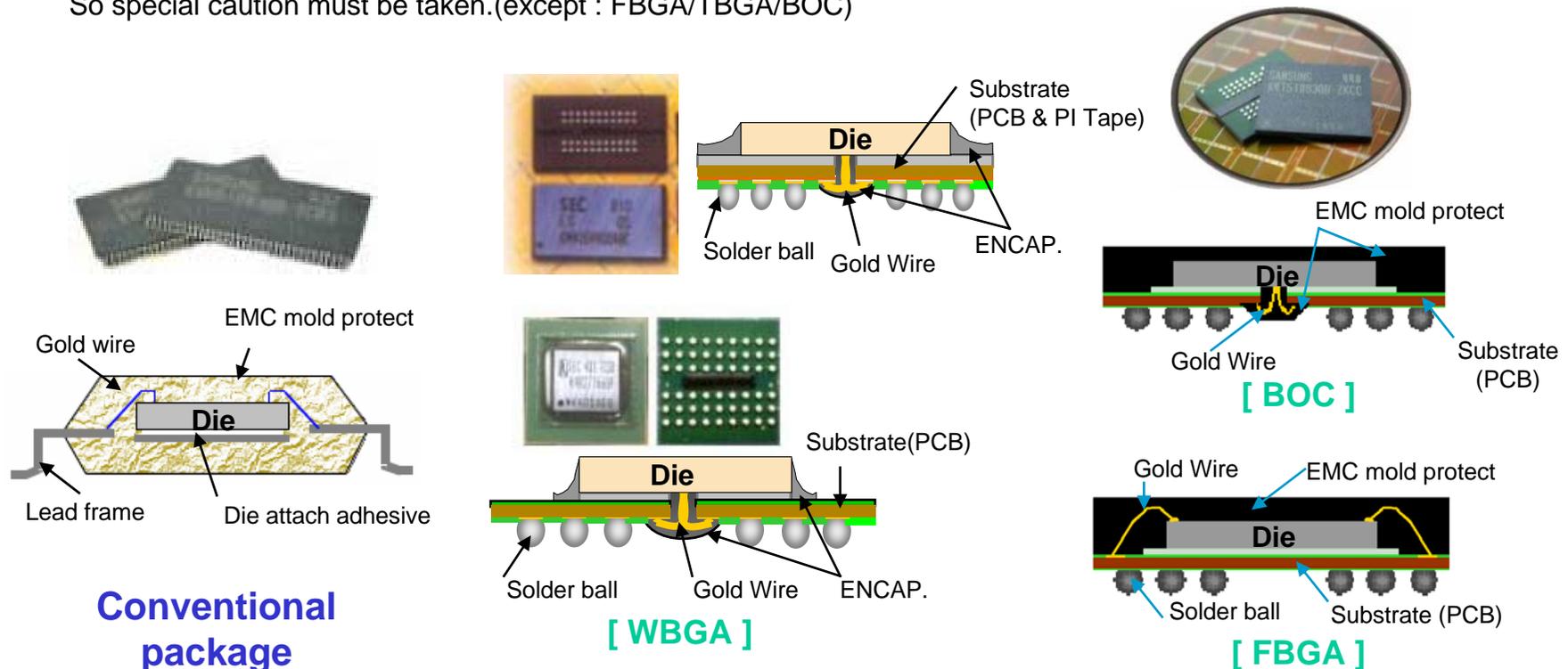
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# 1. Understanding of CSP type package



## 1) Structure comparison between Conventional and CSP

- CSP type component is very brittle and fragile because of its characteristics.  
That's why a special attention must be paid to machine jamming and handling before assembled in PCB board and during progress.
- CSP(WBGA) has no EMC mold protection, because of its size and speed issue so, if it is bumped, dropped or handled carelessly, Mostly function failure occurs.  
So special caution must be taken.(except : FBGA/TBGA/BOC)



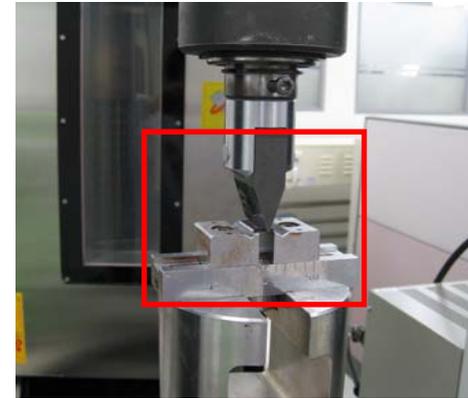
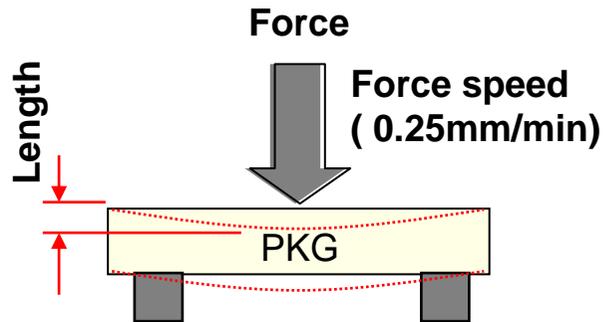
Chip scale package

# 1. Understanding of CSP type package



## 2) Bending Test comparison between conventional and CSP

- Test method



CSP			Conventional type Package		
Device	Length (mm)	Breakdown point (kgf)	Device	Length (mm)	Breakdown point (kgf)
128M SDRAM 54WBGA	0.13	<b>7.16</b>	64M SDRAM 54TSOP2	0.17	<b>21.76</b>
512M DDR2 60BOC	0.17	<b>5.87</b>			
256M GDDR3 144FBGA	0.23	<b>CHIP Broken : 13.6</b>	256M SDRAM 54TSOP2	0.11	<b>29</b>
	0.48	<b>PKG Broken: 24.3</b>			
256M SDRAM 54FBGA	0.45	<b>CHIP Broken : 4.30</b>			
	0.57	<b>PKG Broken : 4.85</b>			

- Without EMC Mold protection, CSP is about 4 times weaker than Conventional package.

# 1. Understanding of CSP type package



## 3) Main CSP failure mode (WBGA Type)

### ◆ Chip crack caused by mechanical damage

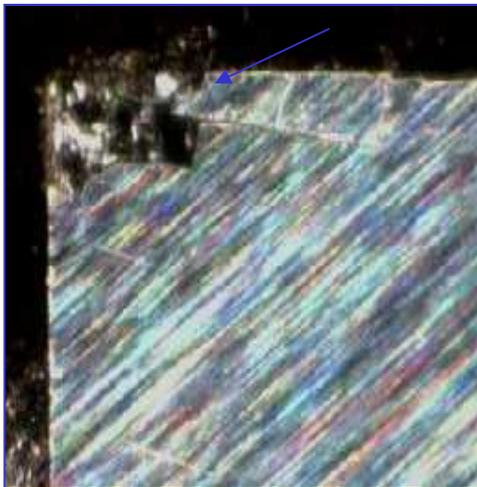


Fig 1 : Top view

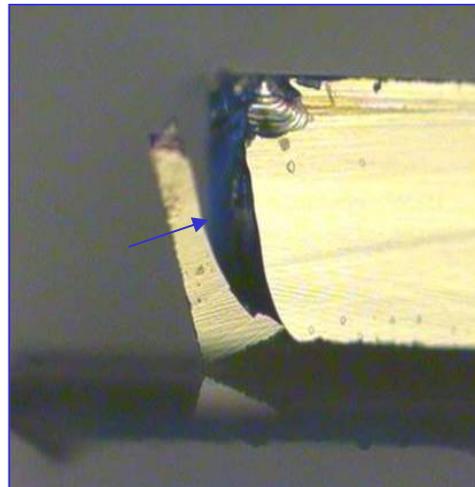


Fig 2 : Side view

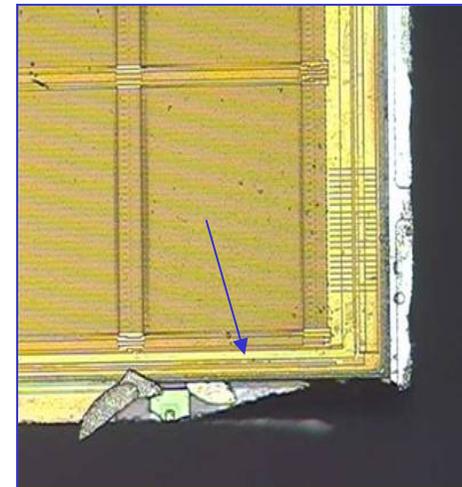


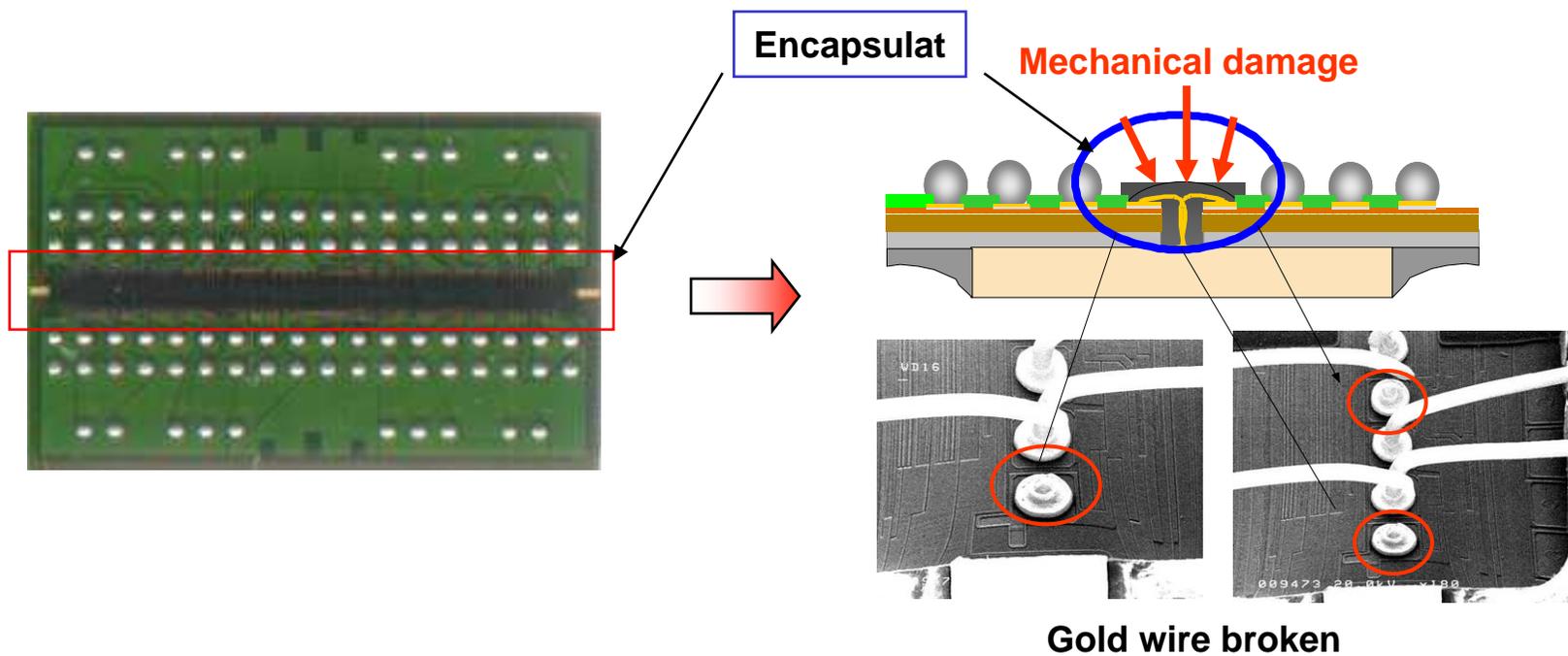
Fig 3 : Cell crack(after decap)

- Due to its structure, the edges are very weak against physical damage that can affect wafer pattern.
- So, the most common factors of functional failure are chip crack and chip out.
- Be sure to use vacuum pad in handling (one by one handling, tray to tray handling)

# 1. Understanding of CSP type package



## ◆ Gold wire broken caused by mechanical damage



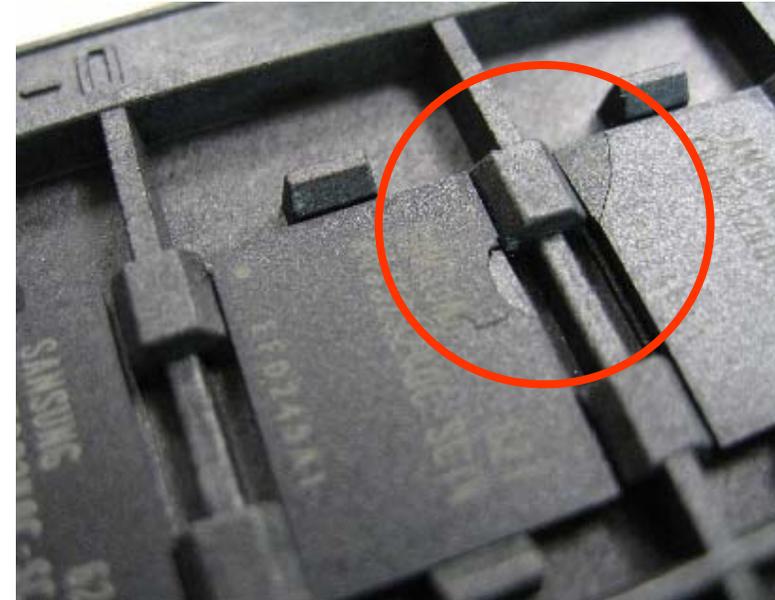
- By very soft Silicone type Encapsulant, Gold wire is covered, so touching this area or handling on it, is prohibited.

# 1. Understanding of CSP type package



## 4) Main CSP failure mode(FBGA Type)

### ◆ PKG Broken caused by mechanical damage



- Because of slight package weight, it is easy to escape from package tray.
- Because of tray handling (Move it on tray bended)

# 1. Understanding of CSP type package

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## 5) Operators handling to CSP to be educated thoroughly.

- CSP(WBGA) is not a conventional package whereby the chip is protected with EMC for physical damage. To handle such a fragile part in the PCB assembly manufacturing environment, exceptional care is required. The operators handling the chip have to be educated thoroughly on the handling procedure.

## 6) Minimum handling is required.

- The layout for CSP package are fully automatic with minimum handling.

## 2. General Handling method

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### 1) Box conveyance

- Do not open except for approved protective work station
- It is recommended surface mount products should be assembled after opening this moisture barrier bag, under 30도/60% R.H within 70 days
- deliver the products with specified packing(SEC packing specification)  
do not change packing material or shape
- Do not to strike the box materials with hard objects or step on them
- DO not re - packing the box during transfer to user without SEC's approval
- Do not drop the box higher than 70cm otherwise inside products will be damaged
- Do not fill up more than 6 stack (large size box)

## 2. General Handling method



### 2) Reel Type Handling Guidelines

- CSP is packed by Tray or Reel type according to customer's request.
- Reel type packing is filled up with N2 gas.

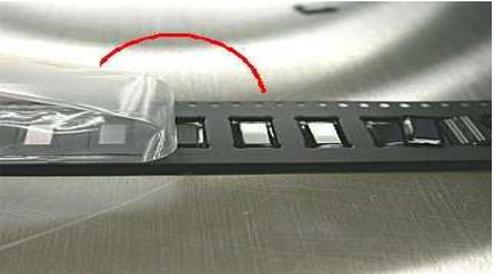


Picture	Description
	<ul style="list-style-type: none"> <li>• CSP packed Carrier Tape should not be unreeled not to be touched on the floor.</li> <li>☞ Touching on the floor might causes CSP broken or chip crack failures.</li> </ul>
	<ul style="list-style-type: none"> <li>• Reel packing should not be distorted during Un-Reel.</li> <li>☞ CSP may be out of the reel pockets.</li> <li>☞ It may causes the chip mounting M/C error.</li> <li>☞ CSP may be damaged.</li> </ul>

## 2. General Handling method



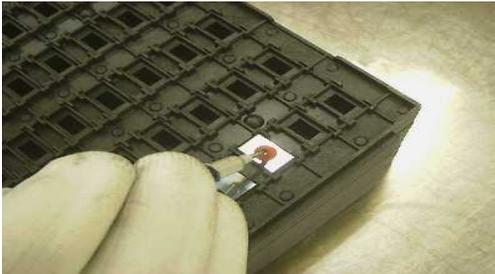
### 2) Reel Type Handling Guidelines

Picture	Description
	<ul style="list-style-type: none"><li>● Tools or other things should not be on the reel.<ul style="list-style-type: none"><li>☞ Otherwise, CSP may be damaged.</li><li>☞ If tape hole is damaged, Chip mounting M/C will have error</li></ul></li></ul>
	<ul style="list-style-type: none"><li>● Be careful not CSP to be distorted from the reel pockets during peeling the cover tape from carrier tape<ul style="list-style-type: none"><li>☞ Recommending cover tape peeling angle is more than 120°</li></ul></li></ul>
	<ul style="list-style-type: none"><li>● When storing the some-used reel packing, reel at least 50cm vacant pocket to protect CSP.</li></ul>

## 2. General Handling method



### 3) Tray Type Handling Guidelines

Picture	Description
	<ul style="list-style-type: none"><li>● During CSP handling, use of metallic material (especially tweezers ) is prohibited.</li><li>● A single CSP must be handled one by one.</li><li>● Be sure to put on the wrist strap.</li></ul>
	<ul style="list-style-type: none"><li>● Be sure to use vacuum pad in CSP handling.</li><li>● One by One handling</li></ul>
	<ul style="list-style-type: none"><li>● Keep CSP at a designated location (Tray) and do not deposit a number of CSP in an overlapping way.</li><li>● Holding or storing CSP in an overlapping way is prohibited.</li></ul>

## 2. General Handling method



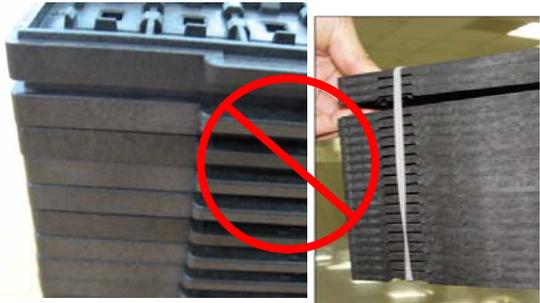
### 3) Tray Type Handling Guidelines

Picture	Description
	<ul style="list-style-type: none"><li>● Be sure to use vacuum pad instead of the hands when inserting or pulling CSP into or from tray.</li><li>● A single CSP must be handled one by one.</li><li>● Be sure to put on the wrist strap</li></ul>
	<ul style="list-style-type: none"><li>● Tray containing CSP is susceptible to damage with a slight shock and the secondary damage by dislocation inside tray is possible.</li><li>● One by One Handling</li></ul>
	<ul style="list-style-type: none"><li>● CSP dislocated inside tray must be moved to its proper position with using vacuum pad.</li><li>● Loading of tray with CSP dislocated inside tray can cause CSP crack.</li></ul>

## 2. General Handling method



### 3) Tray Type Handling Guidelines

Picture	Description
	<ul style="list-style-type: none"> <li>when you handle a tray, must check 4 side stacked tray.</li> </ul>
	<ul style="list-style-type: none"> <li>when you moves stacked tray, you must benidng it. (minmun 2 side or cross bending)</li> </ul>
-	-

## 2. General Handling method



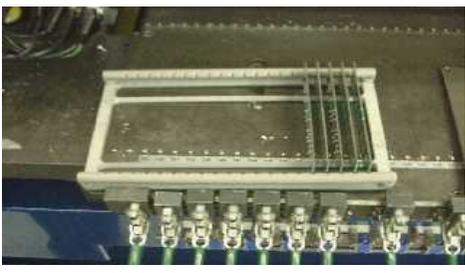
### 4) Mounting Process(module PCB)

Picture	Description
	<ul style="list-style-type: none"> <li>● When jamming occurs in the conveyor belt feeding CSP, those CSP must be stored in tray, handling it one by one with vacuum pad.</li> <li>● Be sure to put on the wrist strap.</li> </ul>
	<ul style="list-style-type: none"> <li>● If jig loading PCB is kept between equipments during 2nd surface printing process, CSP bumps against equipment , thereby causing WBGA crack.</li> <li>● One by One Handling</li> </ul>
	<ul style="list-style-type: none"> <li>● If assembled PCBs are handled in an overlapping way, many WBGA cracks might occur. (Never handle assembled products in an overlapping way.)</li> <li>● One by One Handling</li> </ul>

## 2. General Handling method



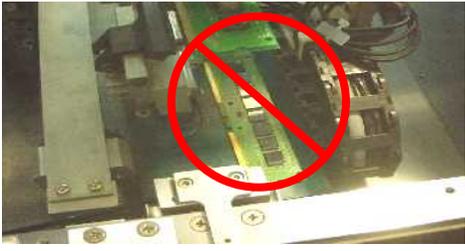
### 4) Mounting Process(module PCB)

Picture	Description
	<ul style="list-style-type: none"> <li>● If assembled PCB falls on the floor, CSP crack occur 100% .</li> <li>● If some PCBs fall on the floor, scope inspection over all fallen PCBs shall be performed. CSP crack defect shall be screened 100% and then subsequent process shall flow.</li> <li>● Be sure to handle it one by one..</li> </ul>
	<ul style="list-style-type: none"> <li>● If failure occurs during 2nd surface printing process and 1st surface part with CSP is placed on the equipment bottom, CSP crack will occur.</li> <li>● If product causes failure during printing process, be sure to insert it into Cleaning Jig to clean it.</li> </ul>
	<ul style="list-style-type: none"> <li>● This is Cleaning Jig insertion status of the modules</li> <li>● failed in the printing process; such products should be</li> <li>● moved also in Jig status after cleaning.</li> <li>● Holding or storing PCB in an overlapping way is prohibited.</li> </ul>

## 2. General Handling method



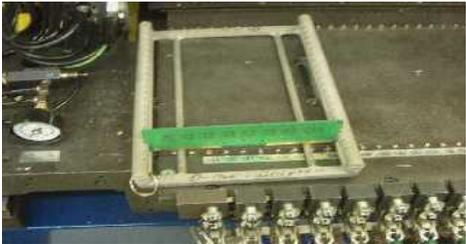
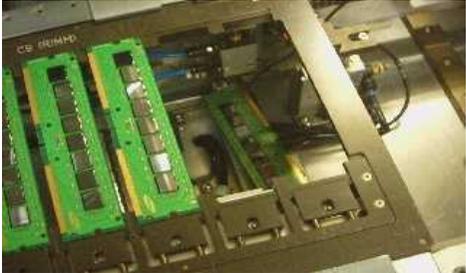
### 4) Mounting Process(module PCB)

Picture	Description
	<ul style="list-style-type: none"><li>● Use of metallic material (especially Tweezers) in CSP Handling is prohibited.</li><li>● A single CSP product must be handled one by one.</li><li>● Be sure to put on the wrist strap</li></ul>
	<ul style="list-style-type: none"><li>● Avoid handling PCBs in an overlapping way when performing visual inspection and never leave modules on the floor.</li><li>● PCBs must be handled one by one.</li></ul>
	<ul style="list-style-type: none"><li>● When printing process causes PCB failures, store PCBs in Cleaning Jig; if Cleaning Jig is not available, keep CSP attached Surface from facing the floor.</li><li>● Locating PCBs on the floor is prohibited.</li></ul>

## 2. General Handling method



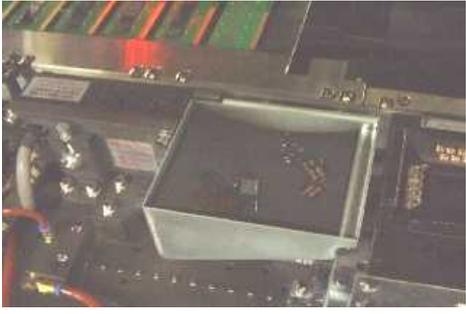
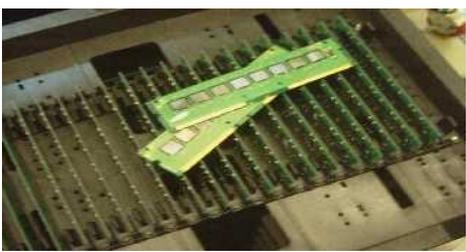
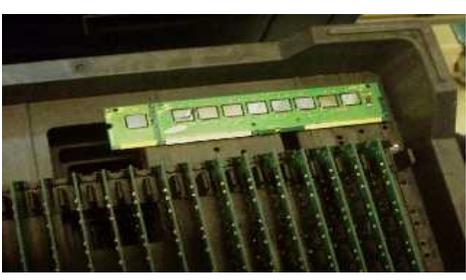
### 4) Mounting Process(module PCB)

Picture	Description
	<ul style="list-style-type: none"><li>● Cleaning jig in which PCBs are inserted is prohibited to be located on the rail of equipment; it must be stored in a safe place. Be sure to put on the wrist strap.</li></ul>
	<ul style="list-style-type: none"><li>● If PCB falls on the floor in the unloading process due to equipment jamming, take out the product one by one to perform scope inspection over all fallen modules to screen failures.</li></ul>
	<ul style="list-style-type: none"><li>● Handle PCBs one by one.</li><li>● Minimize equipment trouble.</li></ul>

## 2. General Handling method



### 4) Mounting Process(module PCB)

Picture	Description
	<ul style="list-style-type: none"><li>● CSP stored in the scrap box should be taken out one by one for which scope inspection should be performed. Only good products should be flowed to next.</li><li>● A CSP must be handled one by one.</li><li>● Be sure to put on the wrist strap.</li></ul>
	<ul style="list-style-type: none"><li>● Placing assembled PCB on Recycle Jig or Recycle Device is prohibited.</li><li>● One by One Handling</li></ul>
	<ul style="list-style-type: none"><li>● Placing assembled module products on Recycle Jig or Recycle Device is prohibited.</li><li>● One by One Handling</li></ul>

## 2. General Handling method



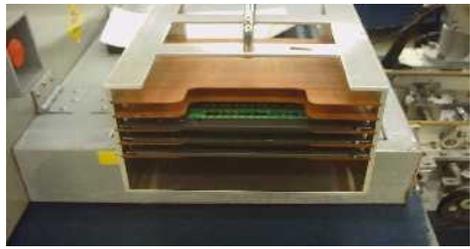
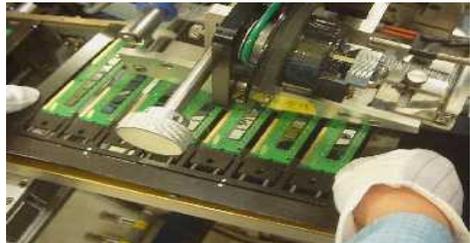
### 4) Mounting Process(module PCB)

Picture	Description
	<ul style="list-style-type: none"><li>● Placing assembled module products on the floor (metallic material, equipment, product) is prohibited.</li></ul>
	<ul style="list-style-type: none"><li>● Jig with PCB attached should be handled as one by one as possible; when Jig is stored in an overlapping way, arrange it in an orderly manner.</li></ul>
	<ul style="list-style-type: none"><li>● Jig with PCB attached must follow Auto Process (loading, unloading, in-process of various equipment)</li><li>● If manual operation should be performed inevitably, it must be stored in a safe place.</li></ul>

## 2. General Handling method



### 4) Mounting Process(module PCB)

Picture	Description
	<ul style="list-style-type: none"> <li>● When PCBs move (QC X-Ray Inspection, Monitor, etc.) be sure to use the dedicated Jig and it is prohibited to move Jig in an overlapping way.</li> <li>● RIMM products must be handled one by one.</li> </ul>
	<ul style="list-style-type: none"> <li>● When monitor or QC is performed in unloading stage, it is required to monitor in Jig status, not a single module status.</li> <li>● One by One Handling</li> </ul>
	<ul style="list-style-type: none"> <li>● When operators take out Jig from Rail to perform monitor or QC in unloading stage, ensure that CSP don't bump against the equipment.</li> <li>● Holding or storing CSP in an overlapping is prohibited</li> </ul>

## 2. General Handling method



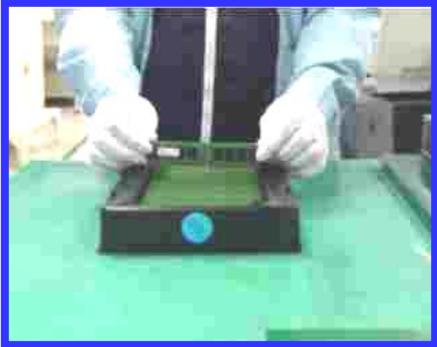
### 4) Mounting Process(module PCB)

Picture	Description
	<ul style="list-style-type: none"><li>● This show the way PCBs are dropped on the equipment due to jamming in the equipment rail; first minimize the equipment trouble and if PCBs fall on the floor, 100% inspection by scope must be performed to screen failures</li></ul>
	<ul style="list-style-type: none"><li>● Minimize equipment trouble when loading PCBs on Recycle Tray in Unloading stage; if loading mistake is occurred, place the products in their proper location and then next process shall flow</li></ul>
	<ul style="list-style-type: none"><li>● Dragging the loaded Recycle Tray on the floor is prohibited.</li><li>● If the loaded Recycle Tray is dragged on the floor, tray may be tripped on the floor, which causes CSP crack.</li></ul>

## 2. General Handling method



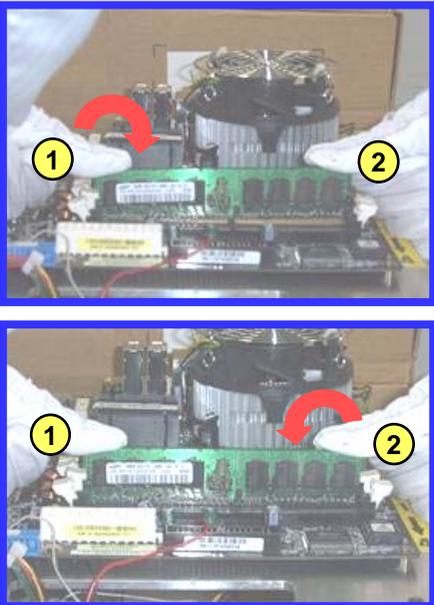
### 5) Memory Module Handling Guidelines (Proper Handling)

Picture	Description
	<ul style="list-style-type: none"><li>● Anti - ESD Strap or ESD safe work mat should be applied.</li></ul>
	<ul style="list-style-type: none"><li>● Memory module should be picked up from packing tray only one by one. Please hold it gently with two hands</li></ul>

## 2. General Handling method



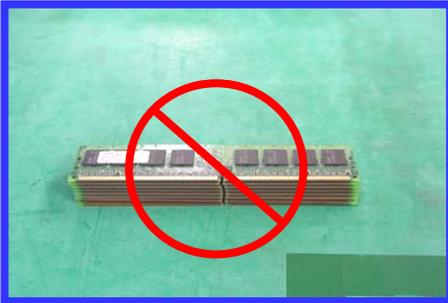
### 5) Memory Module Handling Guidelines (Proper Handling)

Picture	Description
	<ul style="list-style-type: none"><li>● Place a memory module gently on the socket in both hands.</li></ul>
	<ul style="list-style-type: none"><li>● Press both top sides of PCB as left thumb, separately. Insert one top side of PCB and then insert the other side. ex) ① → ② or ② → ①</li></ul>

## 2. General Handling method



### 5) Memory Module Handling Guidelines (Wrong Handling)

Picture	Description
 	<ul style="list-style-type: none"><li>● Do not stack two or more memory modules</li></ul>
	<ul style="list-style-type: none"><li>● Do not grasp two or more memory modules at one time.</li></ul>

## 2. General Handling method



### 5) Memory Module Handling Guidelines (Proper Handling)

Picture	Description
	<ul style="list-style-type: none"><li>● Do not drop memory modules to the floor.</li></ul>
 	<ul style="list-style-type: none"><li>● Handling memory modules near to tool jig is prohibited because Rigid Metals can give memory modules damage.</li></ul>

## 2. General Handling method



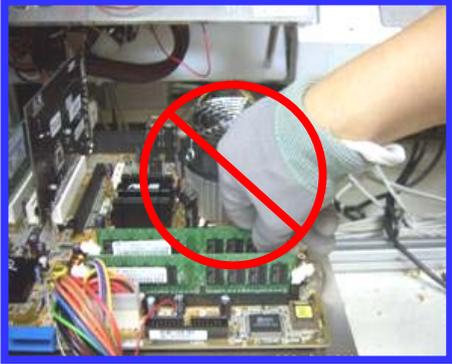
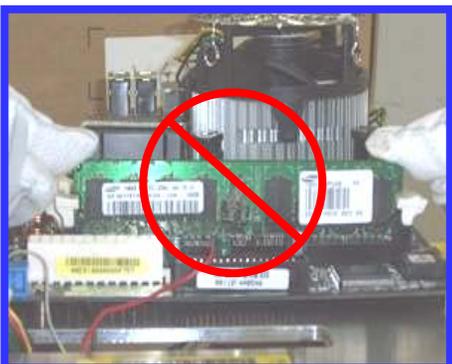
### 5) Memory Module Handling Guidelines (Wrong Handling)

Picture	Description
	<ul style="list-style-type: none"><li>● Do not twist or bow a memory module</li></ul>
	<ul style="list-style-type: none"><li>● Do not stack memory modules in a hand</li></ul>

## 2. General Handling method



### 5) Memory Module Handling Guidelines (Wrong Handling)

Picture	Description
	<ul style="list-style-type: none"><li>● Do not insert with holding packages and passive elements, it can cause package cracks and detachment of passive elements by higher inserting force</li><li>● Insert only one memory module at one time, do not insert multiple memory module at the same time.</li></ul>
	<ul style="list-style-type: none"><li>● Do not press both sides of PCB at the same time.</li><li>● Pressing with both hands at the same time may cause solder joint cracks and package cracks by memory module twist and bow, because Inserting force in both sides at the same time is higher about two times than one given separately.</li></ul>

### 3. Defect mode & cause in mounting process



#### 1) Chip crack defect

- Dislocations of chip on Tray pocket by handling.
- Chip-mounter's improper pick-up position.
- Improper Tray loading on Chip - mounter.

#### Recommending

Mounting Pick and placer.	
Picker Collect	Steel with bottom side rubber pad(Vacuum sucker) (Steel size should be smaller than Chip size)
Placer buffer spring force	Max : 250g, the better the lower
Placing conditions (to PCB)	The mount height : $\pm 0.1$ mm (Regarding PCB bow)
Pick-up conditions (from Tray and Reel&Tape)	The pick-up height : $\pm 0.1$ mm (Regarding Tray bow)

※ Above conditions are for SEC Test and Module process's conditions, so they might be not suitable for the customer, Please regard them as recommendations.

### 3. Defect mode & cause in mounting process



#### 2) Pick-up & Placement Process Guidelines

It is necessary to the control of package pick-up & placement force for preventing the chip crack of package. To guarantee the pick up & placement force, it is important to control the pick up & mount height.

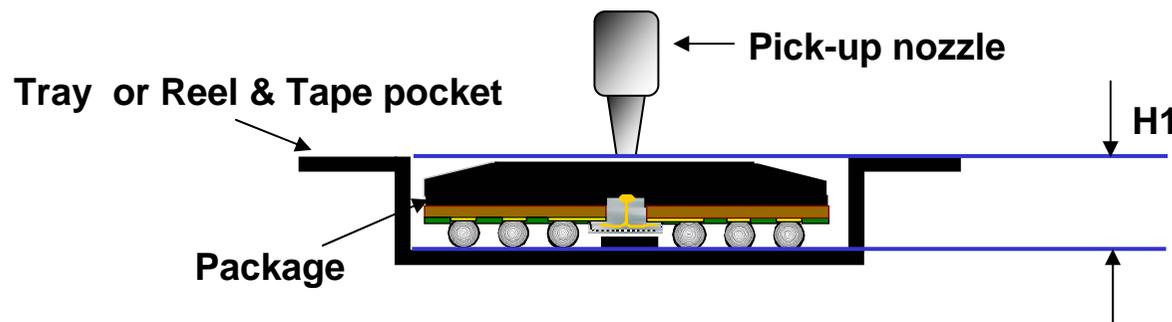
The incongruent pick up & mount height cause the chip crack of package

##### ① Pick-up Process

- Pick-up the package at the proper height level. The height level is the pick-up height(H1) from basic pick-up position to the surface of tray pocket.

The basic pick-up position of each equipment is different.

The pick-up height is selected in the adequate range for preventing excessive down pressure of nozzle



### 3. Defect mode & cause in mounting process

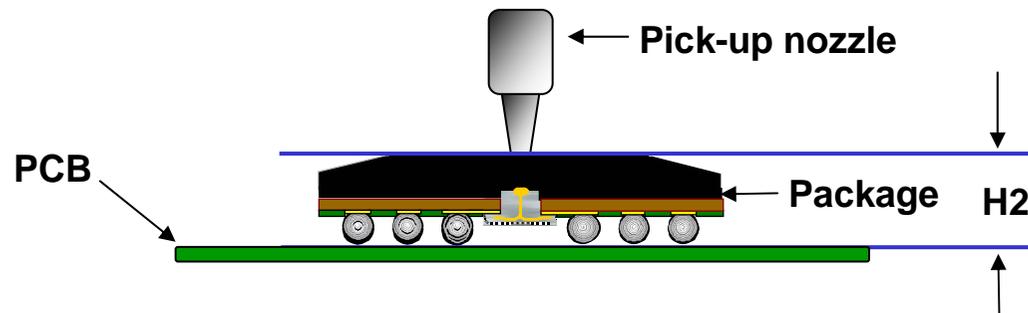


#### ② Placement Process

Placement the package at the proper mount level. The mount level is the mount height(H2) from basic pick-up position of package to the surface of PCB.

The basic pick-up position of each equipment depends on package size.

The mount height is selected in the adequate range for preventing excessive down pressure of nozzle.



### 3. Defect mode & cause in mounting process



#### ③ Recommend Nozzle & Head unit system

- Recommended the pick-up surface of nozzle is flatness for preventing damage and scratch of package.

The nozzle size should be smaller than package size. The inside diameter of nozzle is selected proper size for maintain vacuum pressure for keeping package during nozzle move

- Recommended the head unit system needs an automatic stop function or controller for preventing over pressure to the nozzle or inappropriate mount & pick-up height operation.

The head unit must have buffer spring system for decreasing pressure and impact of placement during nozzle down.

- Recommended the placement buffer spring force is maximum 250g.

# 3. Defect mode & cause in mounting process



## 3) Water cleaning process

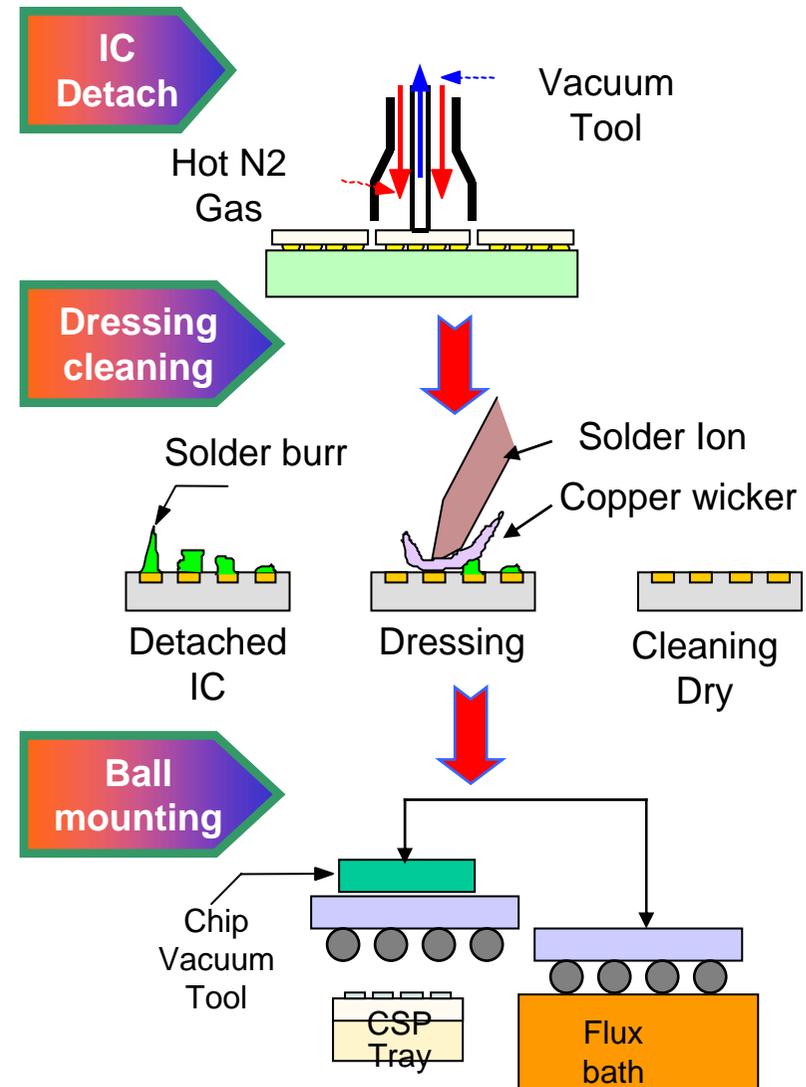
- Basically water cleaning process is not recommended.
    - : Use of No cleaning solder paste is strongly recommended.
  - If the water cleaning process is inevitably requested, CSP should not contact chain and belt area of the cleaning equipment Fixed manual jig should be used.
  - Although jig is used for the process, Dip or Ultrasonic cleaning should be avoided.
  - Sufficient bake after cleaning process is requested to perform completed elimination of moisture and solvent.
  - Solvent + Ultrasonic cleaning process is not recommended either.
- ☞ Main point : HCFC141B solvent chemical(or similar chemical)is deadly affected on gold wire broken of the component.

### 3. Defect mode & cause in mounting process



#### 4) Repair(reball) method process

Weak Point	Method
Chip crack	- Vacuum tool height optimize - Chip support jig : NO CONTACT JIG
Side chip thermal stress	- max peak temp:220℃
Gold wire damaged	- No touch on encap - Do cleaning by manual (prohibit : ultrasonic cleaning)
Tape scratch (Cu patten damage)	- Don't push the over force on solder ion



# 3. Defect mode & cause in mounting process



## 5) Solder joint reliability(1)

### □ Phenomenon

- **Fig 1,2** : Solder joint crack of the component side after surface mounting  
: solder joint crack are happened in the side ball of the component
- **Fig 3** : Magnification the solder joint crack line (fig2) after etching with chemical
- **Fig 4** : EDX spectrum of IMC( table 1 : IMC composition &, thickness data)

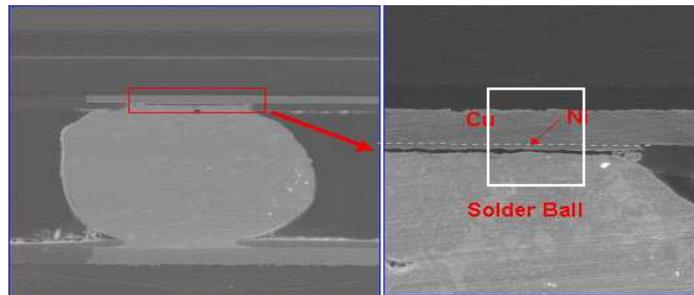


Fig1

Fig2

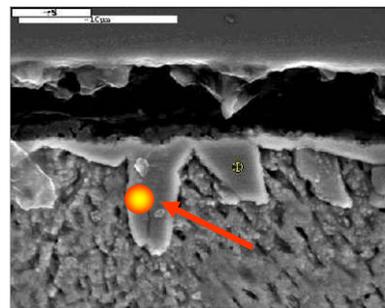


Fig3

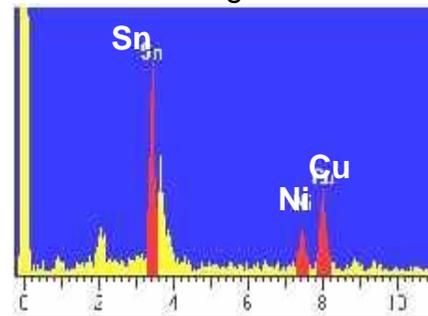


Fig4

Table 1

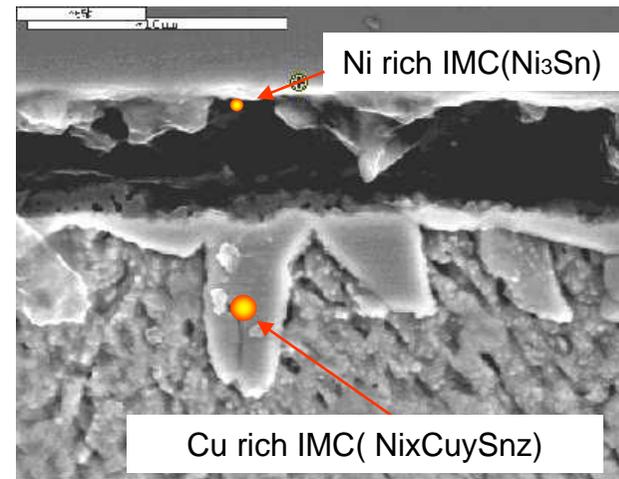
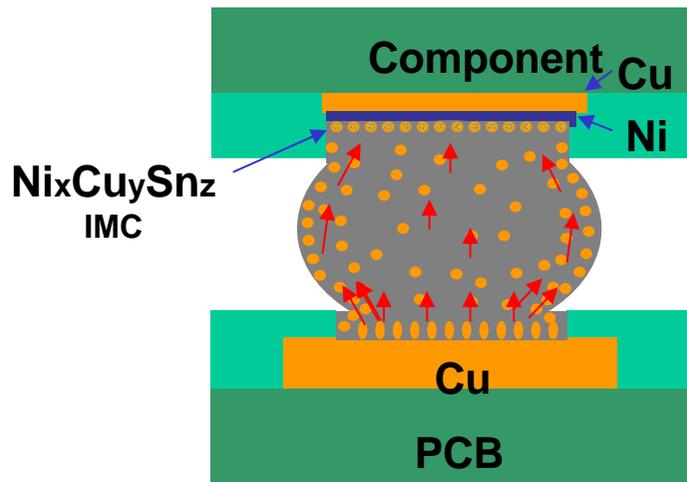
Metal	Atomic %
Ni	21
<b>Cu</b>	<b>41</b>
Sn	38
Total	100
IMC THICK	8 $\mu$ m

### 3. Defect mode & cause in mounting process



#### ❑ Defect cause

- OSP's (organic solder-ability preservative) pad design does not have any Cu diffusion barrier so, during the re-flow Cu in PCB land diffuses to component's solder ball land and make Cu rich IMC(Ni/Cu/Sn). This Cu rich IMC makes solder joint crack, therefore crack easily occurs by mechanical stress



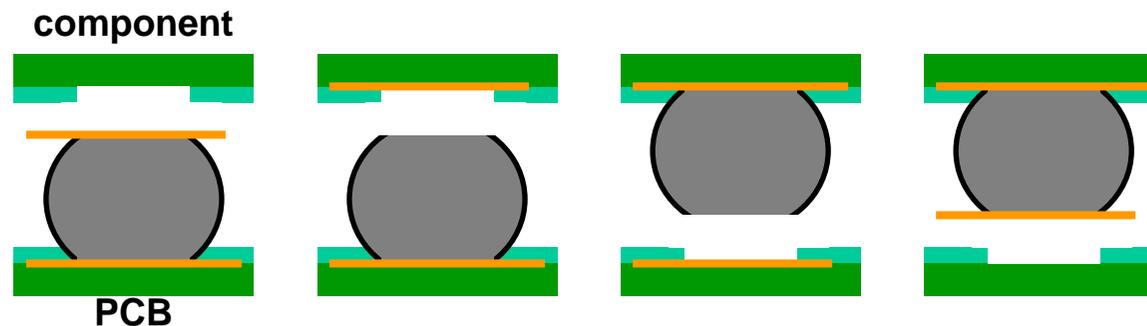
- Cu Diffusion theory : Cu diffuses very fast when it is melted with solder(Sn/Pb) on the high temperature. its outside diffusible speed is more about 10 ~100 times than inside speed.

- It is certain that the Cu rich IMC cannot adhere to the Ni rich IMC, To prevent abnormal growth and spalling of the Cu rich IMC, Cu content in solder and reflow condition should be closely controlled

### 3. Defect mode & cause in mounting process



#### ❑ Fracture mode of pull test comparison between osp and Ni-Au/Cu plating PCB



OSP type	1%	98%	1%	0%
Ni-Au/Cu plating type	1%	1%	75%	23%

#### ❑ Recommending

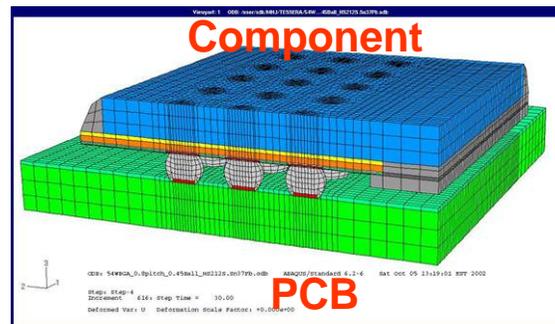
- PCB Solder ball land type : Non Solder Mask Defined(NSMD), Ni-Au/Cu Plating,
- Plating thickness ; Ni : over  $3.0\mu\text{m}$ , Au : over  $0.25\mu\text{m}$
- Plating method : electronic plating
- PCB land diameter with 1:1 ratio to the component land
- **Caution** (If the using OSP type PCB)
  - . Rework or repair (thermal stress)
  - . Mechanical stress (drop, push, etc)

# 3. Defect mode & cause in mounting process

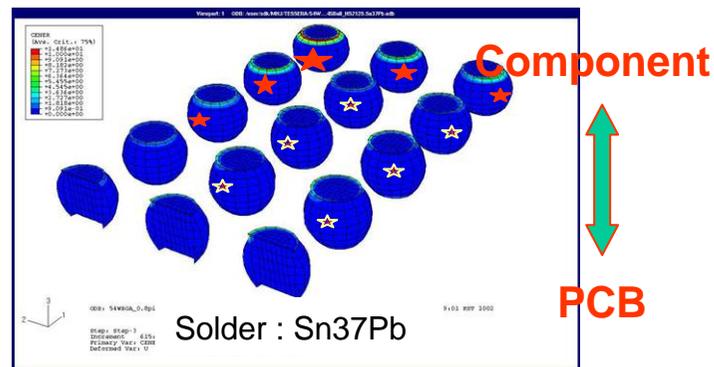


## ※ Remark

- **Why** happened solder joint crack in the side ball of the component ?
- Cause : Side ball of the package are take a more stressed than center ball.  
it is verified by the simulation



Model :WBGA(double mounting)



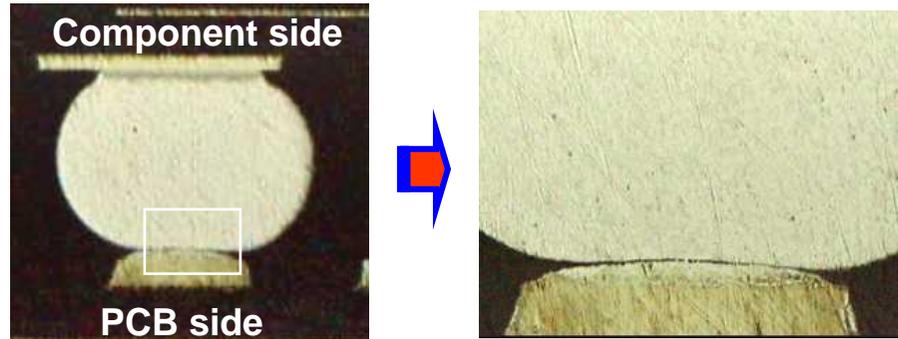
Damage point with mechanical stress

# 3. Defect mode & cause in mounting process

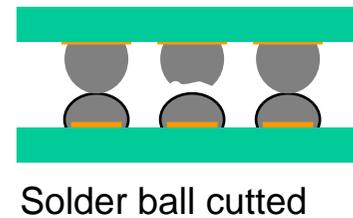
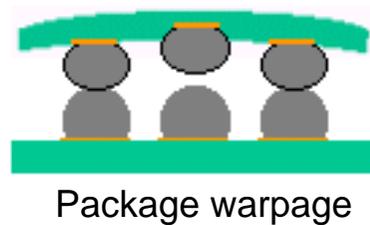
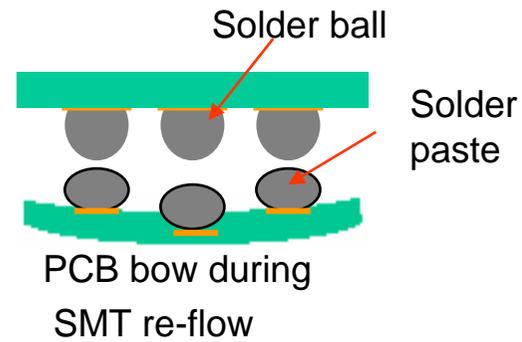
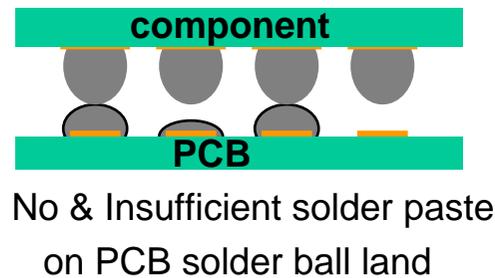


## 5) Solder joint reliability(2)

### □ Phenomenon



### □ Defect cause



### 3. Defect mode & cause in mounting process

---



#### □ Recommending

- Set up the auto inspection system for check paste volume before component loading step on the PCB
- Optimize the the re-flow temperature for surface mounting (PCB bow)
- IQC (Component warpage : within 4mil, ball cutting : within 30% of height)
- Check the contamination of the solder ball and solder ball land

### 3. Defect mode & cause in mounting process



#### 5) Solder joint reliability(3)

##### □ Phenomenon

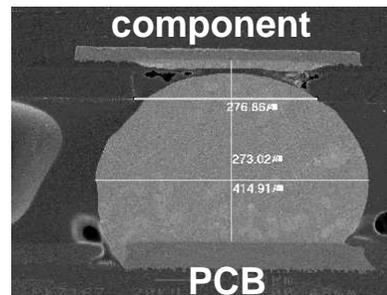


Fig 1

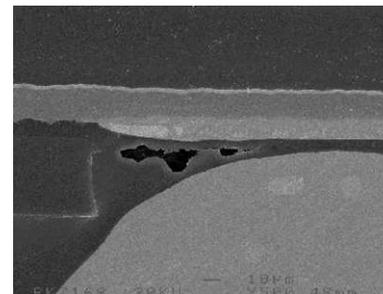


Fig 2



Fig 3

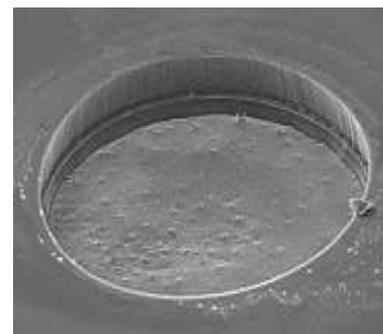


Fig 4

**Fig 3 : fracture surface of ball on the PCB side**

The fracture surface become shine by the re-flow heat

**Fig 4 : fracture surface of ball on the component side**

The fracture surface become shine by the re-flow heat

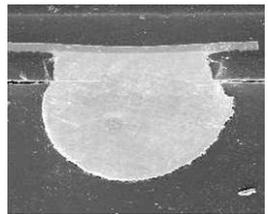
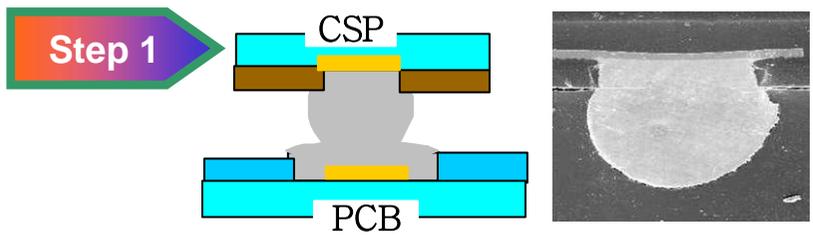
# 3. Defect mode & cause in mounting process



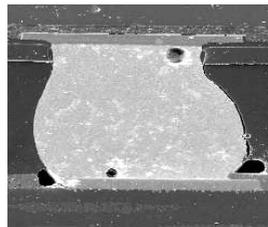
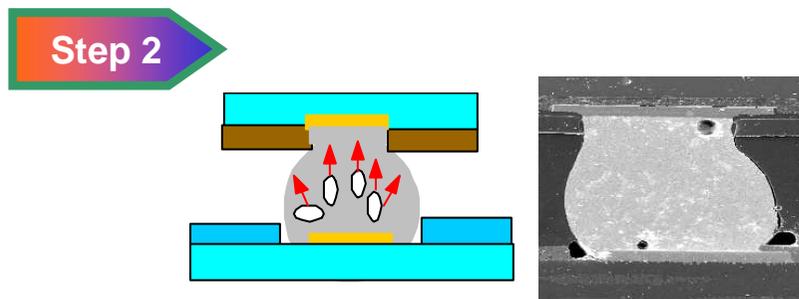
## ❑ Defect cause

- Void in side solder ball that occurred by out gassing from flux of the solder paste in the surface mounting process

### • Void Generation Mechanism



**Step 1 :** There is no solder joint void in component and fracture surface is rough, which is normal.

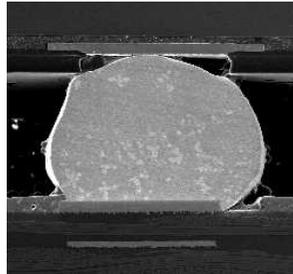
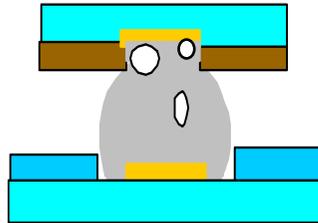


**Step 2 :** During the re-flow, voids can be generated in the ball of the component by the volatilization of the some flux of the paste.

### 3. Defect mode & cause in mounting process

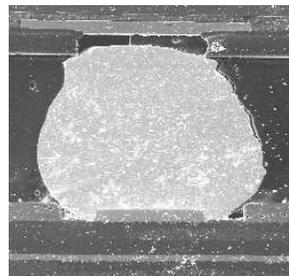
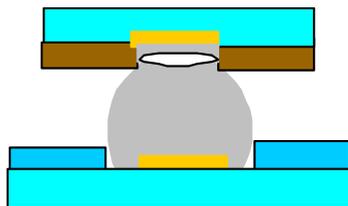


#### Step 3



**Step 3** : As the re-flow temperature increase, the size of voids are getting bigger by combine small voids. And voids move to the side of the component

#### Step 4



**Step 4** : The size of void is maximized at the peak temp of the re-flow. And solder ball can be taken off by the pushing force of gas. The fracture surface become shine by the re-flow heat.

### 3. Defect mode & cause in mounting process



#### □ Recommending

- **Re - Flow Profile**

- Dwell time at pre-heating : 150 ~ 175 °C : 60 ~ 100sec
- Peak Temp : The better low temperature , MAX 220 °C
- dwell time at over 200 °C : 30 ~ 50sec
- Profile Condition : should be closely controlled

- **Solder paste**

- Paste volume : The better the lower
- ※ Re-flow condition should be optimized by the design of experience because of difference the component type, PCB type and atmosphere of re-flow process
- ※ The re-flow profile sharp that the recommended by SEC is tent type.

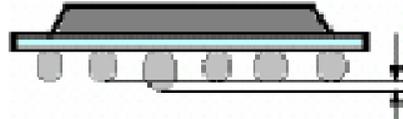
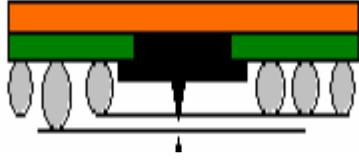
# 4. Visual Inspection Criteria



## ❑ 1. Marking Area

Item	Criteria	Fig.
Marking Typography Cutting	Reject if marking Typography has been cutting	

## ❑ 2. Solder Ball Area

Item	Criteria	Fig.								
2-1 Ball Coplanarity	<p>&gt; FBGA(BOC): Reject if Solder ball coplanarity exceeds below criteria</p> <table border="1" data-bbox="884 877 1545 1141"> <thead> <tr> <th>Ball Size</th> <th>Coplanarity</th> </tr> </thead> <tbody> <tr> <td>~0.29 mm</td> <td>3.2mil (80um)</td> </tr> <tr> <td>0.3~0.44mm</td> <td>4Mil ( 100um)</td> </tr> <tr> <td>0.45mm ~</td> <td>4.5mil (106.7um)</td> </tr> </tbody> </table> <p>&gt;TBGA : Max 3mil (75um)                      &gt;FC-BGA / HBGA : Max 6mil(150um)                      &gt;(U)LGA : Max 4.0mil(100um)                      &gt; WBGA : Max. 4Mil (100um)</p>	Ball Size	Coplanarity	~0.29 mm	3.2mil (80um)	0.3~0.44mm	4Mil ( 100um)	0.45mm ~	4.5mil (106.7um)	 
Ball Size	Coplanarity									
~0.29 mm	3.2mil (80um)									
0.3~0.44mm	4Mil ( 100um)									
0.45mm ~	4.5mil (106.7um)									

# 4. Visual Inspection Criteria



## ❑ 2.Solder Ball Area

Item	Criteria	Fig.								
<p>2-2. Solder Ball Misplacement</p>	<ul style="list-style-type: none"> <li>Reject if Solder ball Misplacement exceeds below criteria</li> <li>- . FBGA (BOC)                             <table border="1" data-bbox="745 571 1373 802"> <thead> <tr> <th>Ball Pitch</th> <th>Misplacement</th> </tr> </thead> <tbody> <tr> <td>1.27mm 이상</td> <td>5mil (125um)</td> </tr> <tr> <td>1.00mm 이상</td> <td>4mil (100um)</td> </tr> <tr> <td>1.00mm 이하</td> <td>3mil (75um)</td> </tr> </tbody> </table> </li> <li>- . MCP, TBGA, WBGA : Max. 3 mil(75um)</li> <li>- . (U)LGA : Max 80um</li> <li>- . FC-BGA : Max 8mil(200um)</li> </ul>	Ball Pitch	Misplacement	1.27mm 이상	5mil (125um)	1.00mm 이상	4mil (100um)	1.00mm 이하	3mil (75um)	
Ball Pitch	Misplacement									
1.27mm 이상	5mil (125um)									
1.00mm 이상	4mil (100um)									
1.00mm 이하	3mil (75um)									
<p>2-3. Double Ball</p>	<ul style="list-style-type: none"> <li>Reject if Solder Ball is fused or connected with adjacent Balls. It is a defect.</li> </ul>									
<p>2-4. Missing Ball</p>	<ul style="list-style-type: none"> <li>REJECT if solder Ball is Missing or incompletely fused in such a way as to cause the PCB Ball Pad pattern to be even slightly exposed. It is a defect.</li> </ul>									

# 4. Visual Inspection Criteria



## ❑ 2.Solder Ball Area

Item	Criteria	Fig.
2-5. Damaged Ball	<ul style="list-style-type: none"> <li>Reject if solder ball cut or crushed over 30% cause the mechanical damage.</li> </ul>	
2-6. Foreign substance in the ball area	<ul style="list-style-type: none"> <li>Conduction Material: Reject for foreign greater than 1/2 between ball and ball.</li> <li>Non conduction material:                             <ul style="list-style-type: none"> <li>- . Reject if The others Foreign Materials short between ball to ball, and size of foreign material exceeds ball pitch.</li> <li>- . Reject if Spots size exceeds 1/2 of PCB Size.</li> </ul> </li> </ul>	

# 4. Visual Inspection Criteria



## 3. External area

Item	Criteria	Fig.
<p>3-1. Warpage</p>	<ul style="list-style-type: none"> <li>Reject if Solder Ball coplanarity exceeds 4Mil</li> <li>However, even though solder Ball coplanarity is good, if Package is so Bent that Package coplanarity deviates from war-Factor (Wf) criteria. Is is a defect.</li> </ul> $Wf = \frac{\text{PKG Warp}(Unit: Mil)}{\text{PKG Length}(Unit: Inch)}$ <p>→ Reject if Wf is 2.5 or more then.</p>	
<p>3-2. Scratch</p>	<ul style="list-style-type: none"> <li>Any exposure of base metal on PSR areas by scratches is rejectable. (Except edge Area (20mil))</li> </ul>	
<p>3-3. Package Burr</p>	<ul style="list-style-type: none"> <li>Reject if PCB or EMC Burr exceeds 4Mil.</li> <li>Reject if burr of PCB Plating Line exceeds 10Mil.</li> </ul>	

# 4. Visual Inspection Criteria



## 3. External area

Item	Criteria	Fig.
3-4. PSR Coverage	<ul style="list-style-type: none"> <li>Reject if base metal or core is exceeds 6Mil. (Max 150um)</li> </ul>	
3-5. Flux Contamination	<ul style="list-style-type: none"> <li>Reject for contamination short between ball and ball ( if there is flux contamination which is removed by air blow, it is not defect.)</li> <li>Reject for flux contamination greater then 2.5 x 2.5mm.</li> </ul>	
3-6 PCB Broken & Crack (FBGA)	<ul style="list-style-type: none"> <li>If crack Caused by PKG Broken attacks solder ball Land or VIA Hole, it is defect.</li> <li>If PCB Edge area exceeds 20mils(Length)x20mil (Width), it is defect.</li> <li>defect if base metal is exposed. (Visual Inspection or scope (X30) Inspection.)</li> </ul>	

**THE END**