

ULA (Ultra Low Alpha)

Dedicated Line for

FC BGA



Presented by

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Santa Clara, USA

Content



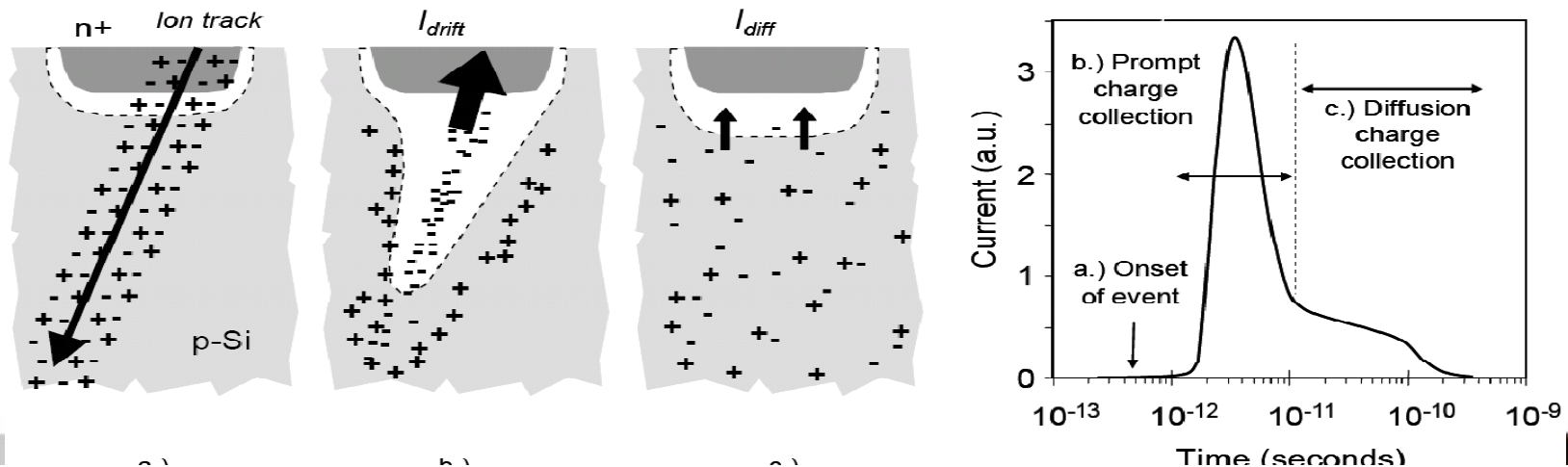
- Introduction
- Low Alpha Particle Control Strategy
- Raw Material Management
- Design / Layout Confirmation
- Dedicate Line for Assembly
- Summary



Introduction - Soft Error



- Soft Error / SER (Soft Error Rate)
 - High energy particle creates **electron-hole pairs** in the silicon.
 - Charges drift and collect at nodes, producing a **prompt current**.
 - Charges diffuse toward the nodes, producing **lower current**.
 - When **current accumulated** large enough, memory states is switched.
 - High chip density, smaller device dimensions & lower voltage increase the susceptibility of memory devices to soft error.
(SoC, SRAM, DRAM, ...)



R. C. Baumann, *IEEE Trans. Device Mater. Reliab.*, vol. 5(3), p. 305-316, Sept. 2005

Introduction - Solution for Soft Error



- Three conditions to cause soft errors:
 - Present within **50 um** of the device surface
 - With a **direct line of travel** to the device surface
 - Number of electrons storage well **exceed critical charge**

Source: IEEE Transaction on Reliability, Soft Errors Induced by Alpha Particle (1996)

- To eliminate the alpha particles:
 - **Less susceptible design** (Move source away from devices).
 - **Add shielding** (Die coatings or polyimide thin film)
 - **Packaging materials** (Using low / ultra low alpha particle)

Source: Tezzaron Semiconductor, Soft Error in Electronic Memory - A White Paper (2004)



Low Alpha Particle Control Strategy

Low Alpha Particle Control - Scope



Material been monitored:

1. Molding Compound/ Liquid Encapsulant
2. Solder Paste.
3. Flip Chip Underfill.
4. Epoxy/ Epoxy Film (for STK PKG)
5. Substrate Pre-solder.

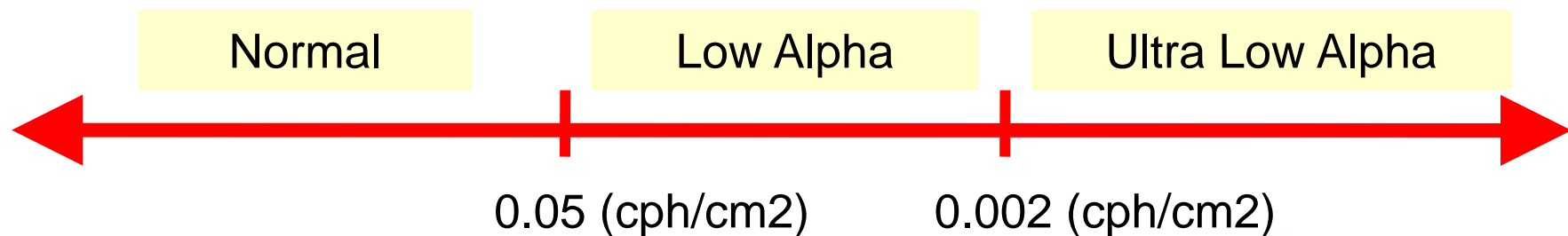
New Device:

Define Control Level in PDM.
after aligning with Customers.

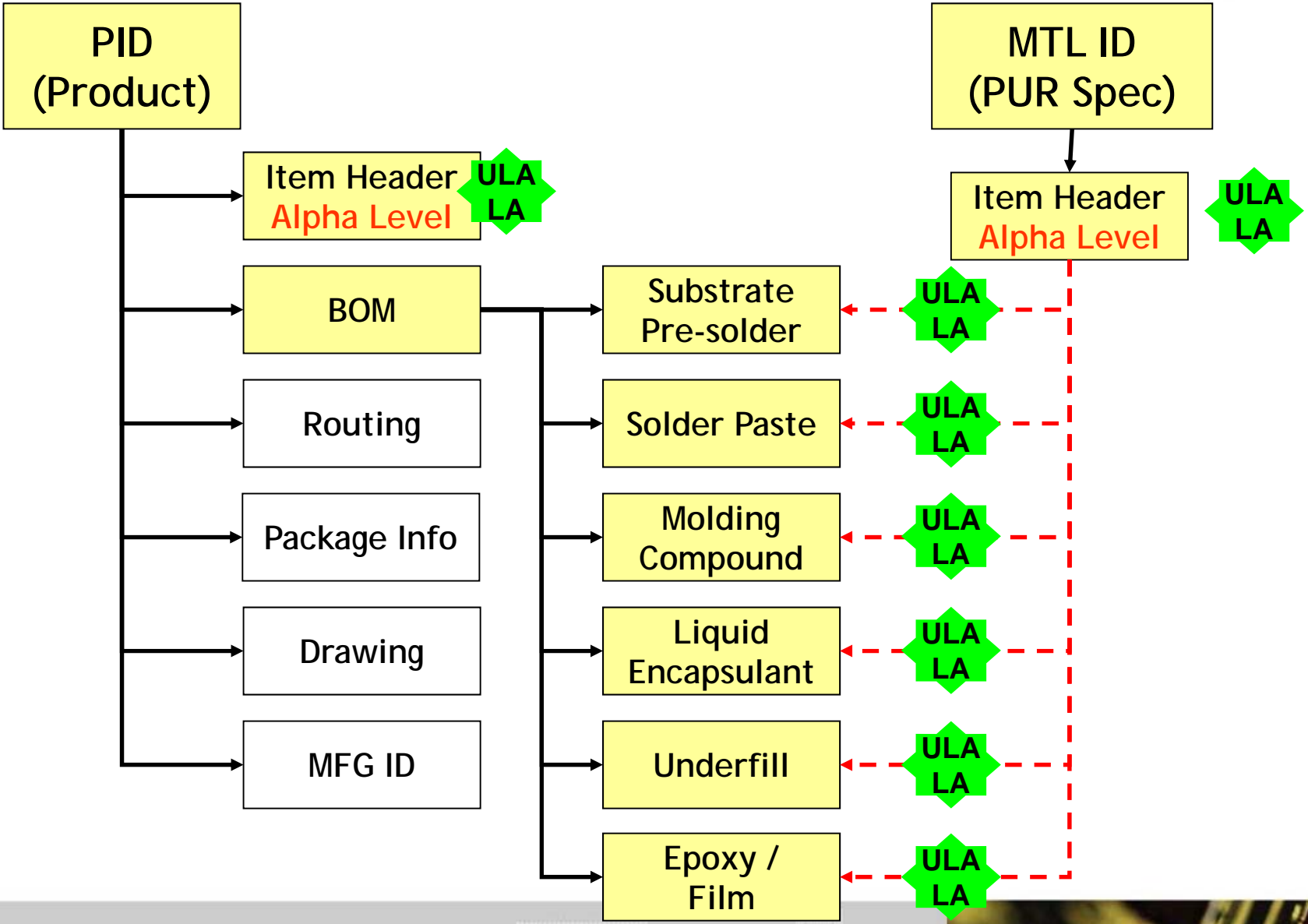
Old Device:

No Action.
unless have any Special instruction.

Material alpha particle control level criterion (unit : count/hour-cm²)



Low Alpha Particle Control - Mechanism ASE GROUP



Low Alpha Particle Control - Working Plan ASE GROUP

Work Item	Q1	Q2	Q3	Q4
A. Organization				
A.1 Teaming Up (CDE/CPE/MPE/QA/Pricing/PUR/MM/IQA/MFG/MIS)				
A.2 Role & Responsibility, KPI Definitions				
B. Basic Data Preparation				
B.1 Material PUR Spec Buildup for Alpha Ray control Level				
B.2 Vendor Inspection Report Collection & Buyoff				
C. IT System Development				
C.1 New Data Item & Checking Logic Coding				
C.2 Table Creation & Data Migration				
D. Engineering Preparation				
D.1 Training & Certification for ASE Alpha Control Policy				
D.2 APQP, AMQP, RA, Design Flow Modification				
E. Manufacture Preparation				
E.1 Management & Containment of Radioactive Contaminants				
E.2 Training & Certification for ASE Alpha Control Policy				

Raw Material Management

Raw Material Management - by package

- Wire Bond (L/F & BGA) Package
 - Molding Compound/ Liquid Encapsulant
 - Epoxy / Epoxy Film (for STK PKG)

- Flip Chip package
 - Solder Paste for chipcap
 - Underfill
 - Substrate (pre-solder) for FC bond.
 - Molding Compound (for MFC PKG)
 - Epoxy / Epoxy Film (for STK PKG)

- WLP package
 - Solder Paste for printing
 - *Anode / Plating solvent for plating

Raw Material Management - measurement capability

Measurement Capability set up :

In-house or certified third Party for ULA monitoring

Co-work with Third party to set up ULA measuring capability :

- * Equipment Survey:
- * Test Method Survey:
- * Certification Standardization :



Raw Material Management - PID release system

Number	Item	EC
	MTL00007300	64-05-3400-0000073
Name	ASE-UA03	
Location ID	DEFAULT LOCATION	DEFAULT LOCATION
Control location	DEFAULT LOCATION	DEFAULT LOCATION

- Step 1 : Input MTL P/N (PUR Spec) α Level.
- Step 2 : Provide Engineer RA result & BOM.
- Step 3 : Input Product Device α Level.
- Step 4 : BOM data maintenance.
- Step 5 : Confirm BOM align Device's α Level
- Step 6 : Issue travel card ID with α Level for production

NEW PRODUCT DATA LIST

申請者姓名(Name): Jarch Lin 申請日期(DATE): 11/25/2008 文件編號(Doc No):

Condition: CUST_MVL_PKG_KK_LC_655 **DEVICE_78100-A0-BH01** Remark_BD: □ +

PRODUCT: Normal Semi-Product MCM Others Flip Chip

Alpha Control Level: **Ultra low alpha** Green material: Green Non green

產品封裝資訊-標準(Product Assembly Data-Standard)

Operation n°	Item type	Item name	Limited request	Operation	Item type	Item name
		Item				Item
		Number	FCST Device			78100-A0-BH01
		Name	Lead count			655
		Location ID	Body Size			27.00x27.00x0.0
		Control location	Status			Release

● <路單>

● 產品型號: **78100-A0-BH01** ● 發料數量: 5420 STD

● FC BGA 27x27 SUBLOT SIZE: 240

Number	Item	FCST Device
MVL02441E00	Flip Chip	78100-A0-BH01
Name	Flip Chip	Lead count
Location ID	DEFAULT LOCATION	655
Control location	DEFAULT LOCATION	Body Size
Status	Release	27.00x27.00x0.0

Description for Travel Card FC BGA 27x27

Item Header	Item Comments	Assoc. Data	Resp. Persons	Design Attrib.
Alpha_Control_Level: Ultra low alpha ($\alpha \leq 0.002$)				
Ultra low alpha ($\alpha \leq 0.002$)				
Low alpha ($0.002 < \alpha \leq 0.05$)				
Normal ($\alpha > 0.05$)				
No alpha particle concern				

Description for Travel Card FC BGA 27x27

BOM Header		BOM Comments		BOM		Location Usage		Item Dist. History	
BOM list panel									
Security level UNCLASSIFIED					Security category DEFAU				
	equ	MTL type	MTL name	Component item number					
✓		SOLDER BALL	0.6_96.5SN/3.0AG/0.5CU	1075-36074					
✓		FLUX	ASE-FA06	1078-610629					
✓		FLUX	WF-6400	1078-864074					
✓		UNDERFILL	ASE-UA03	MTL000007300					
✓		SUBSTRATE	A10456_0_BT HL830/830HS/BT	MTL0000025108					



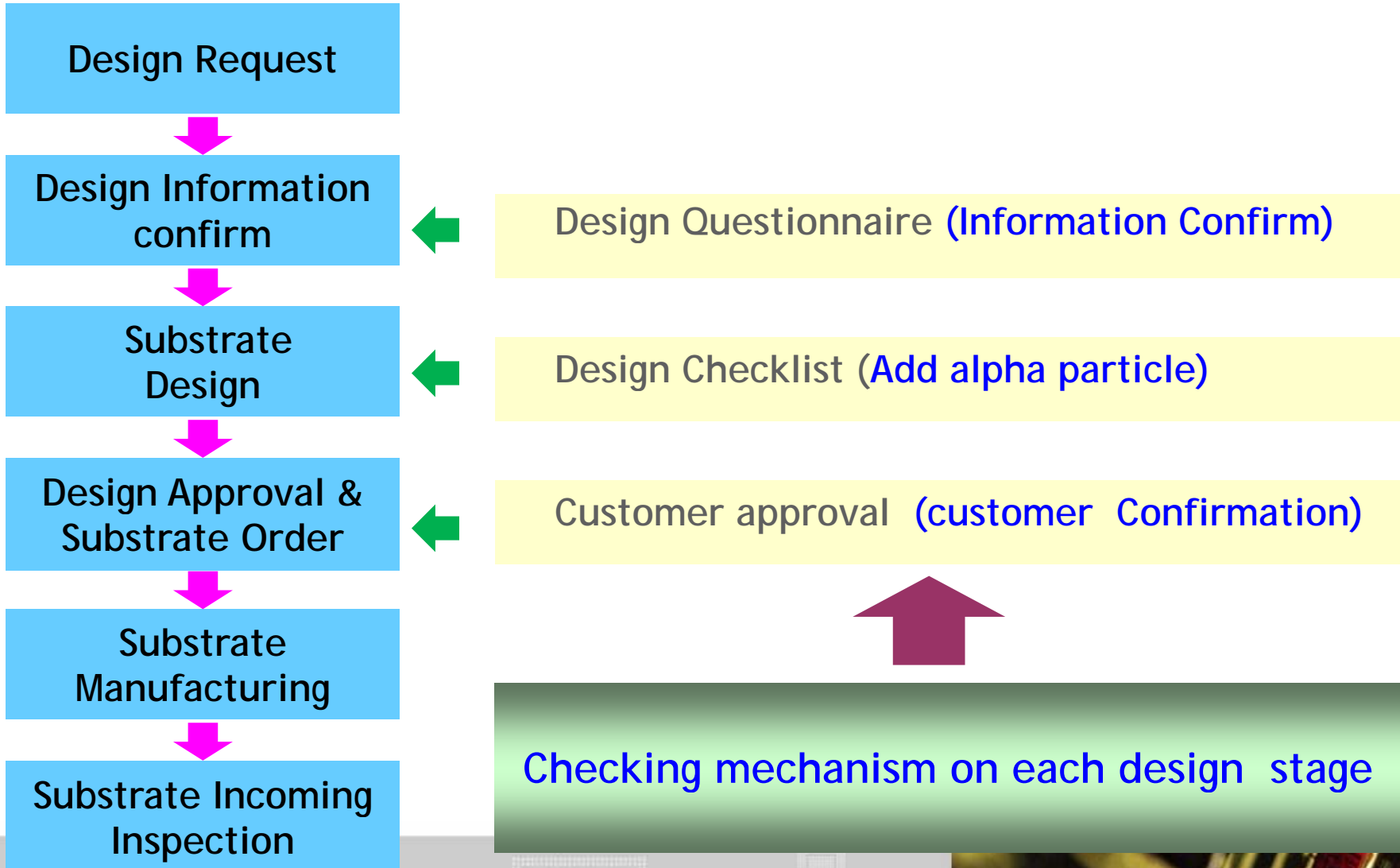
Drawing / Design Layout Confirmation



Package Certification



Drawing /Design Layout



Package Certification



Drawing / Design Layout

Design Checklist

- Add alpha particle information

Flip-Chip BGA Substrate Design Cover Sheet

• Design-Project # (Need to fill in the blank of base information)..... Ref. E.

Customer:	Package type:	Device name:
Package size:	L/C:	Substrate thickness:
Package code:	Ball size:	Substrate layers:
Ball pitch:	Chip size:	Substrate type: <input type="checkbox"/> Green <input type="checkbox"/> RoHS <input type="checkbox"/> Normal
Bump pitch:	UBM dia.:	Bump composition:
Bump face: <input type="checkbox"/> Up <input type="checkbox"/> Down	Bump pad type: <input type="checkbox"/> SMD <input type="checkbox"/> NBMD	Presolder: <input type="checkbox"/> N <input type="checkbox"/> Y (EU or LF)
Metal finish		Special requirement
<input type="checkbox"/> Double side presolder <input type="checkbox"/> Immersion Tin <input type="checkbox"/> Plated Tin <input type="checkbox"/> OSP <input type="checkbox"/> ENIG		<input type="checkbox"/> None <input type="checkbox"/> Thermal lid + Ring <input type="checkbox"/> Stiffener ring only <input type="checkbox"/> HAT <input type="checkbox"/> Cavity <input type="checkbox"/> Thermal lid only <input type="checkbox"/> Other
Heat spreader		SMD Request: <input type="checkbox"/> Y <input type="checkbox"/> N
		<input type="checkbox"/> Refer to attach file of special request list
		<input type="checkbox"/> X-Section #
		<input type="checkbox"/> Wafer out:

New design: Tsk #

DOC. NO.	Sub. DWG No.	B/D No.	POD No.	Eng. Sign



Modify: Tsk #

• Design-Project # (Need to fill in the blank of base information)..... Ref. E.

Customer:	Package type:	Device name:
Package size:	L/C:	Substrate thickness:
Package code:	Ball size:	Substrate layers:
Ball pitch:	Chip size:	Substrate type: <input type="checkbox"/> Green <input type="checkbox"/> RoHS <input type="checkbox"/> Normal
Bump pitch:	UBM dia.:	Bump composition:
Bump face: <input type="checkbox"/> Up <input type="checkbox"/> Down	Bump pad type: <input type="checkbox"/> SMD <input type="checkbox"/> NBMD	Presolder: <input type="checkbox"/> N <input type="checkbox"/> Y (EU or LF)
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Heat spreader		SMD Request: <input type="checkbox"/> Y <input type="checkbox"/> N
		<input type="checkbox"/> Refer to attach file of special request list
		<input type="checkbox"/> X-Section #
		<input type="checkbox"/> Wafer out:

Modify: Tsk #

Drawing type: Substrate drawing & B/D Substrate drawing

Reason of change: Customer Request Improve Design Error Other change

Change item: Refer to attach file of special request list.

DOC. NO.	Sub. DWG No.	B/D No.	POD No.	Eng. Sign

Modify: Tsk #

• Design-Project # (Need to fill in the blank of base information)..... Ref. E.

Customer:	Package type:	Device name:
Package size:	L/C:	Substrate thickness:
Package code:	Ball size:	Substrate layers:
Ball pitch:	Chip size:	Substrate type: <input type="checkbox"/> Green <input type="checkbox"/> RoHS <input type="checkbox"/> Normal
Bump pitch:	UBM dia.:	Bump composition:
Bump face: <input type="checkbox"/> Up <input type="checkbox"/> Down	Bump pad type: <input type="checkbox"/> SMD <input type="checkbox"/> NBMD	Presolder: <input type="checkbox"/> N <input type="checkbox"/> Y (EU or LF)
Metal finish		Special requirement
<input type="checkbox"/> Double side presolder <input type="checkbox"/> Immersion Tin <input type="checkbox"/> Plated Tin <input type="checkbox"/> OSP <input type="checkbox"/> ENIG		<input type="checkbox"/> None <input type="checkbox"/> Thermal lid + Ring <input type="checkbox"/> Stiffener ring only <input type="checkbox"/> HAT <input type="checkbox"/> Cavity <input type="checkbox"/> Thermal lid only <input type="checkbox"/> Other
Heat spreader		SMD Request: <input type="checkbox"/> Y <input type="checkbox"/> N
		<input type="checkbox"/> Refer to attach file of special request list
		<input type="checkbox"/> X-Section #
		<input type="checkbox"/> Wafer out:

Modify: Tsk #

Drawing type: Substrate drawing & B/D Substrate drawing

Reason of change: Customer Request Improve Design Error Other change

Change item: Refer to attach file of special request list.

DOC. NO.	Sub. DWG No.	B/D No.	POD No.	Eng. Sign



Package Certification



Drawing /Design Layout

- ULA substrate has different layout drawing #.
- ULA substrate requirement is specified in layout drawing.

1. SUBSTRATE TYPE : SMD WITH SOLDER
2. LAYER : 3+2+3
3. THICKNESS

Alpha Particle SPEC
in drawing

DESCRIPTION	MATERIAL	THICKNESS
FINISHED THICKNESS		1200 +/- 150
PRE-SOLDER	63Sn/37Pb ULTRA LOW ALPHA: ≤ 0.002 cph/cm ²	(*A) C4 Pad
METAL FINISH	IMMERSION TIN	1.0 MIN.

Package Certification



ULA Product Confirmation

RA (Risk Assessment): Product Engineer will check ULA information

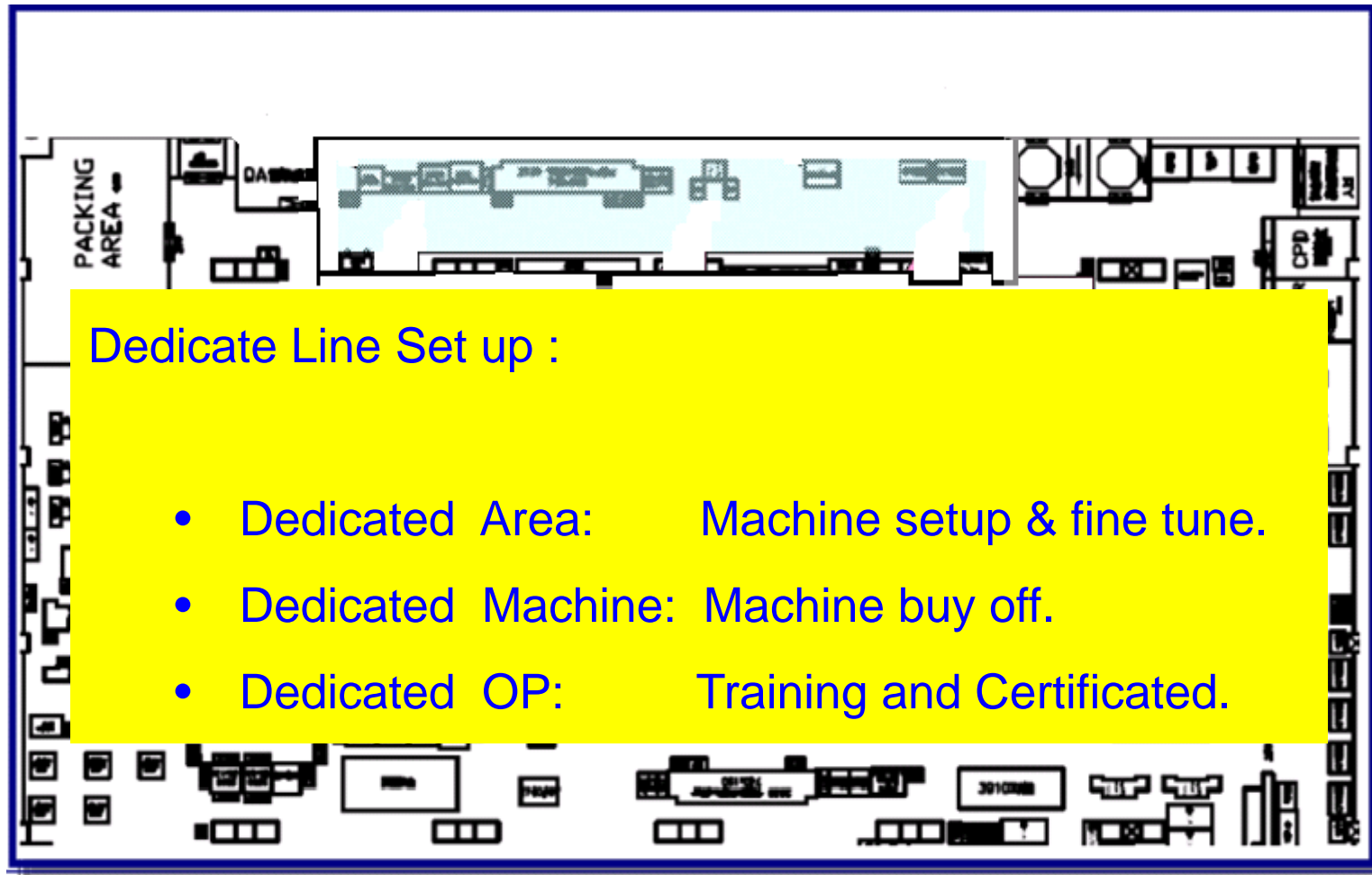
- To see if **any Embedded memory** designed inside chip/ package
- To Check what is the ULA **Alpha particle level requirement**



Dedicated Line for FC BGA Assembly



Dedicate Line Certification



Dedicate Line Set up :

- Dedicated Area: Machine setup & fine tune.
- Dedicated Machine: Machine buy off.
- Dedicated OP: Training and Certificated.



Dedicate Line Certification



Dedicate Machine for ULA Control.

**Wafer Grind / Wafer Mount /
Wafer Saw**

 2nd Optical Gate

Pre-solder Substrate Baking

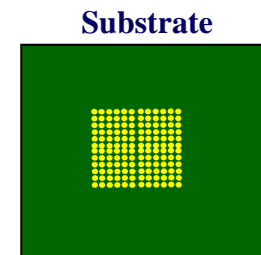
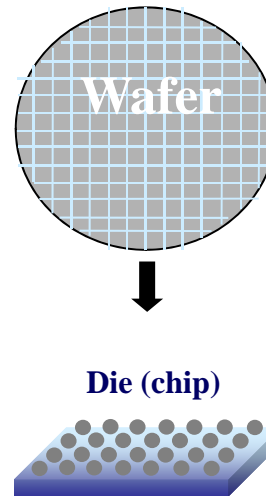
Solder paste Printing

Chipcap Mount

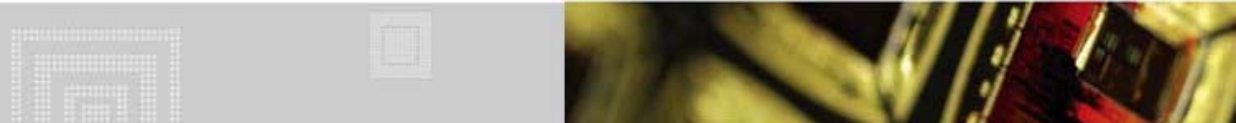
Flux Jetting

Flip Chip Bond / bump reflow

 3rd Optical Gate



**Substrate Baking,
Solder paste Printing,
Chipcap mount**



Dedicate Line Certification



Dedicate Machine for ULA Control.

Substrate Baking

Plasma Clean

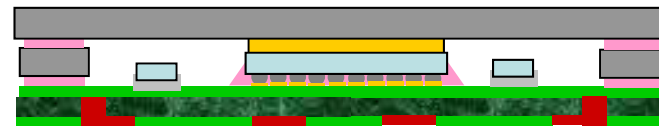
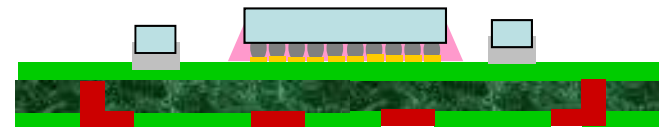
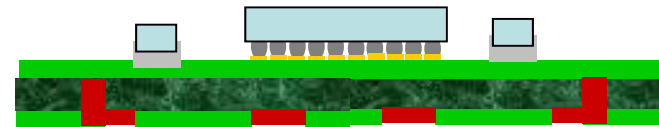
Underfill Dispensing/Curing

Heat Slug Attach & curing

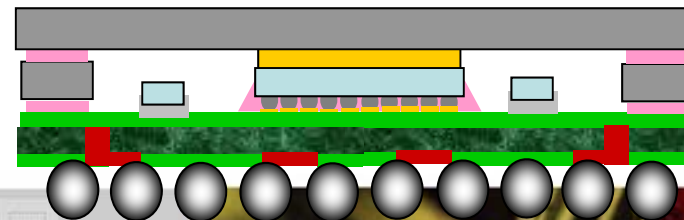
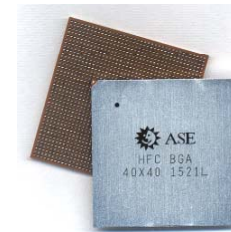
Marking

Ball Mount / reflow / flux clean

Final Visual Inspection



Marking



Dedicate Line Certification



MES System:

Only Certified **ULA Operator** to handle ULA products

Only **ULA material** been used in ULA products

Only **ULA machine** can process ULA products.



Bar code Control

Operator Confirmation

Material Confirmation

Machine Confirmation

Lot ID	Lot Type	Quantity	Step ID	Product ID	Plan Name
20B2A2	NORMAL	2400	2400	AMBAAA0N00	062F0005-062B0207

Equipment Information

Equipment ID	MCID	09	2400-603
State	Capacity		

Summary



1. A dedicated FC line with completed control mechanism :

- ULA requirement identification,
- Packaging design procedure control
- Raw material control,
- In line process control,
- Production certification.

2. WB product has validated existing control mechanism :

- Prevent the alpha particle contamination.



Thank you

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