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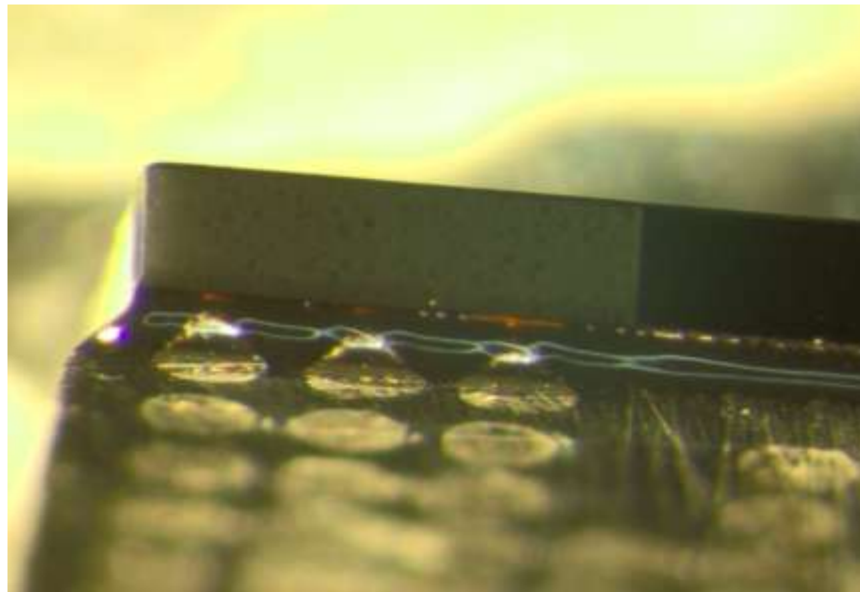
Reverse Costing analysis



eWLB (X-GOLD™ 213) by Infineon
Reverse analysis report of a Fan-out Wafer Level Package

January 2010- Version 1

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Physical Analysis Methodology

- Package is analyzed and measured.
  - X-ray pictures are used to identify the package construction and the redistribution.
- Two cross-sections are realized to get overall package data : dimensions, main characteristics.
- Analysis of the technologies and materials used is provided

The schematic diagram below is constructed from observations made during this study and presented in the next slides.

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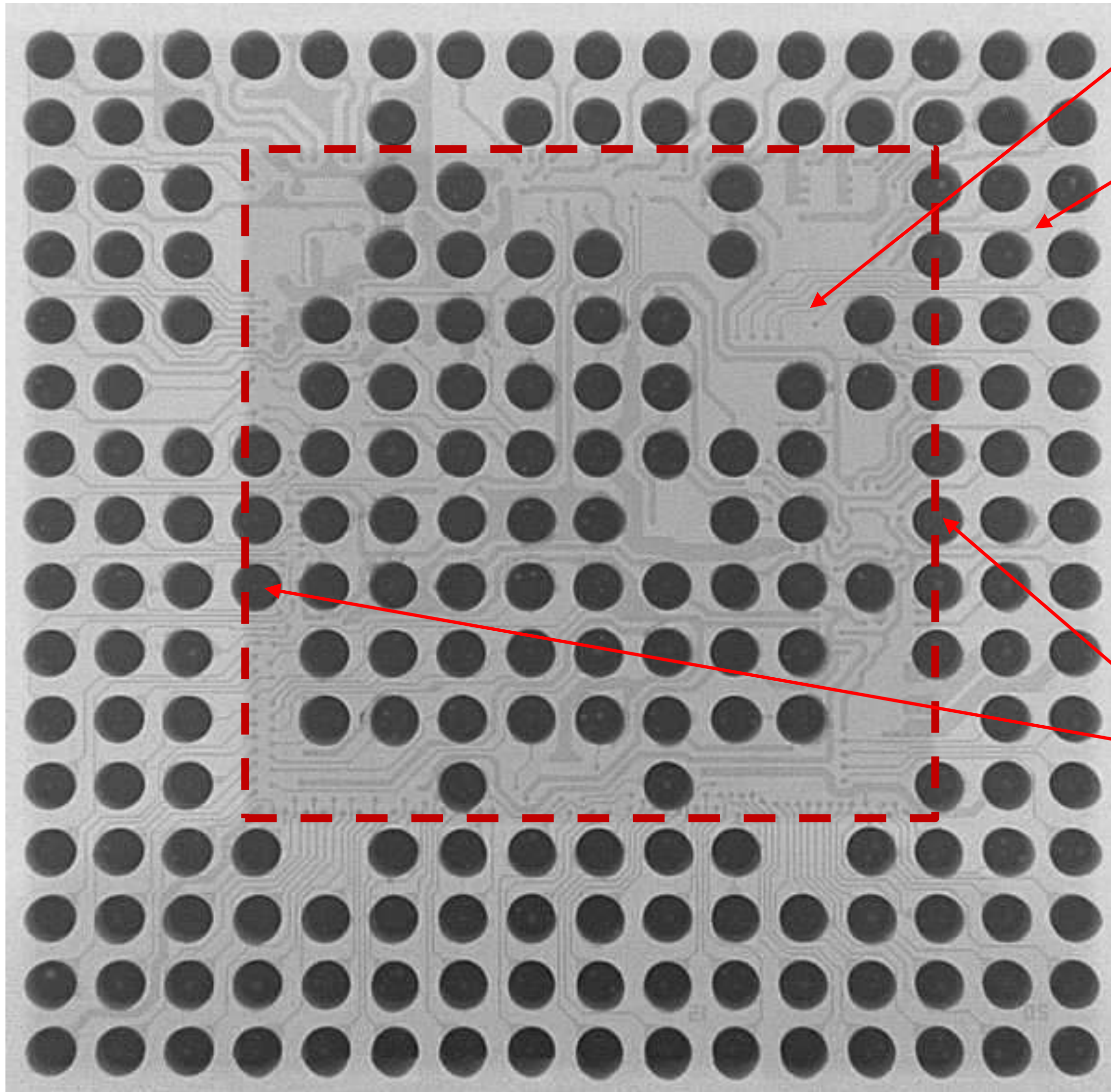
Die in the package

This X-Ray picture of eWLB was taken after removal of the PCB.



Die
5.1mm x 5.1mm = 26.1mm²

Package
8mm x 8mm = 64mm²

The fan-out ratio is 2.46
(package size over chip size)

The die is not centered in the package.

Some balls are right below the edge of the die and the fan-out area

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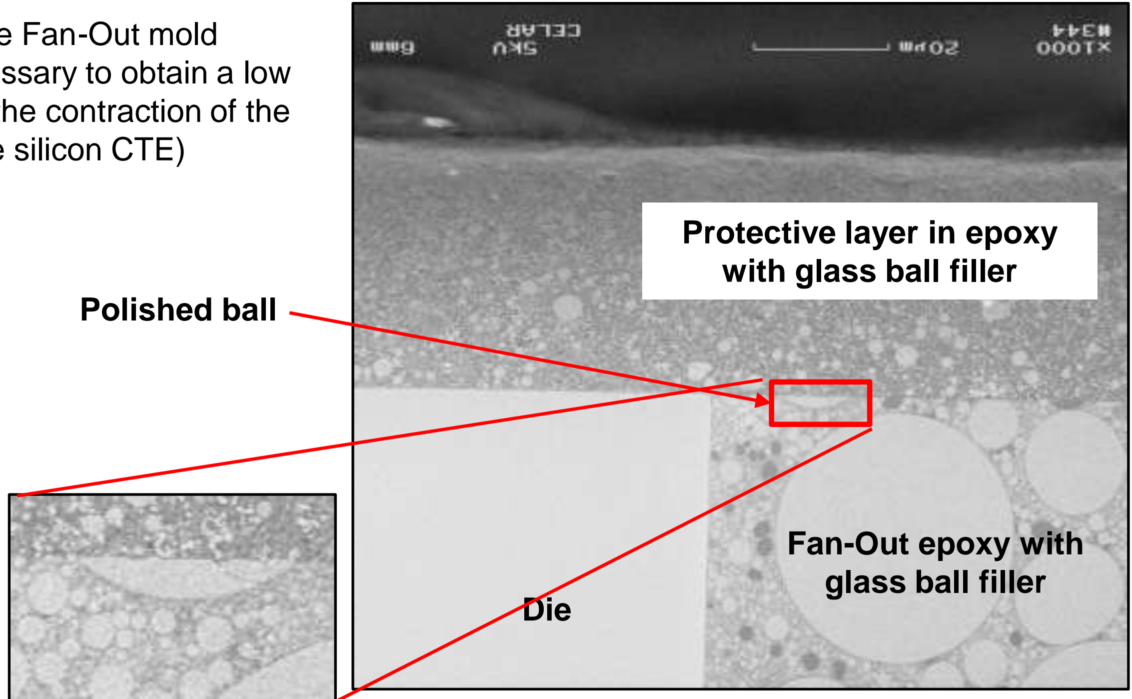
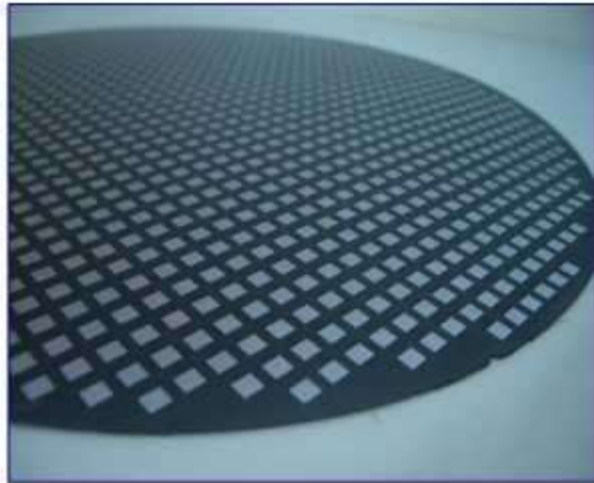
Fan-Out back side

The back side of the wafer, after the wafer molding step, is grinded. It can be seen that the glass balls sealed within the mold compound were polished. A protective layer was deposited.

The filler content ratio is estimated at 75% of the Fan-Out mold compound. The high percentage of filler is necessary to obtain a low coefficient of thermal expansion (useful to limit the contraction of the reconfigured wafer at molding, and to match the silicon CTE)





Infineon doc : wafer redistributed

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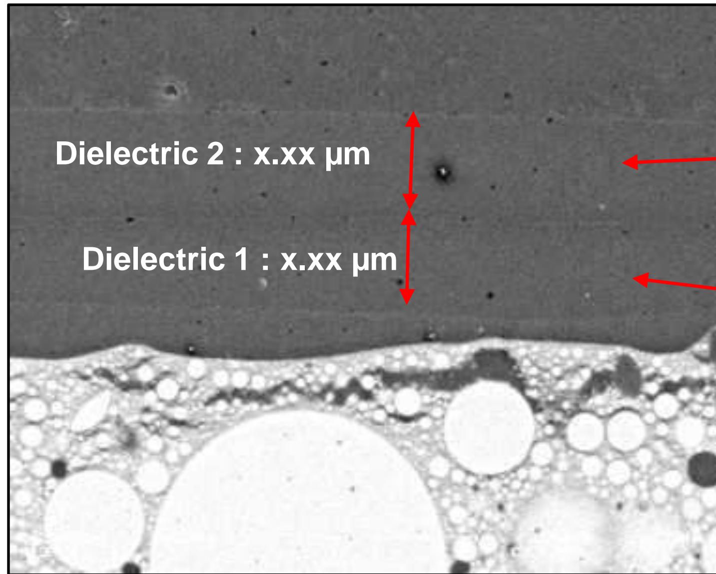
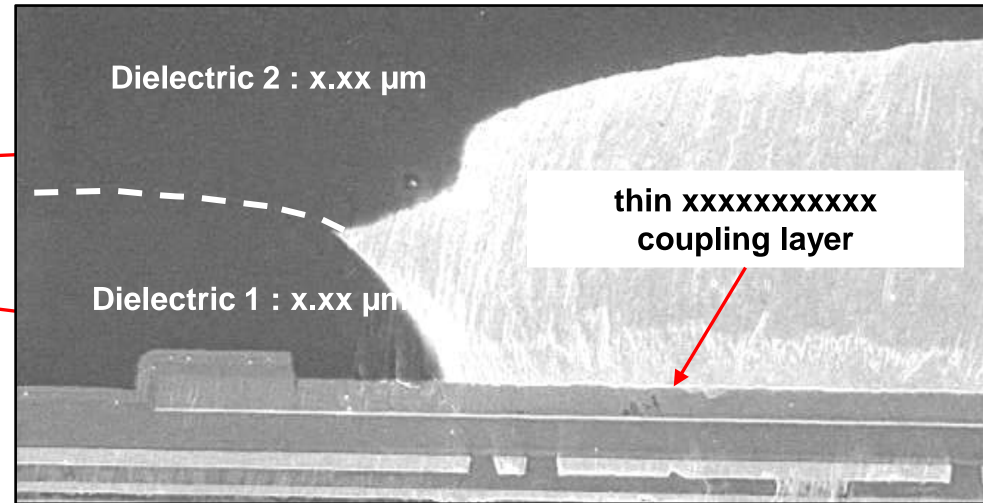
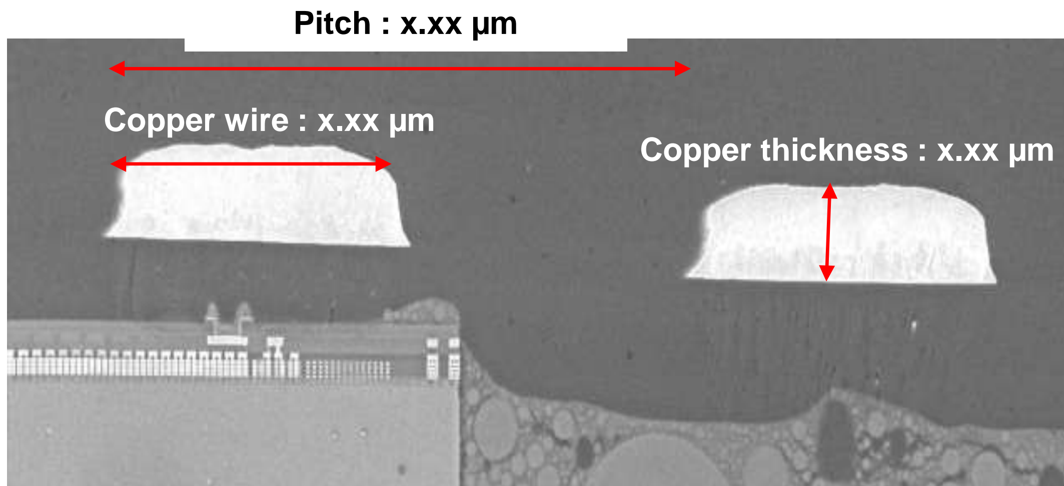
Redistribution layer







We estimate at x.xx ml the necessary volume of dielectric for each layer per 8" wafer.

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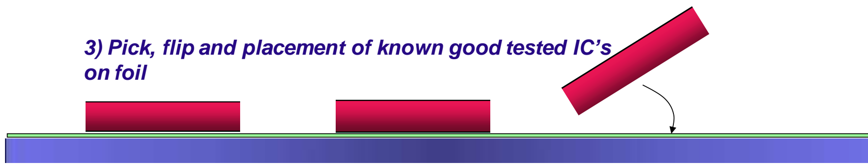
The Process flow main steps

1) Wafer preparation: wafer thinning and sawing

2) Lamination of foil onto carrier

3) Pick, flip and placement of known good tested IC's on foil



4) Wafer molding

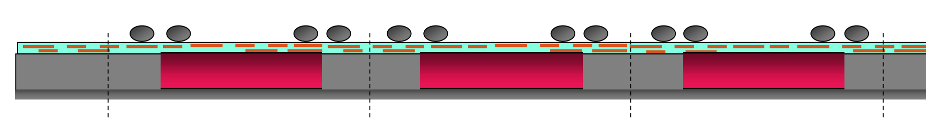
5) Grinding of the epoxy resin (to release the stress difference between both sides so as to avoid wafer warping?)

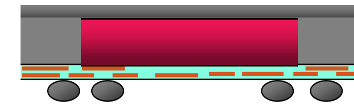
6) spin-on deposition of a back-side epoxy resin protection layer

7) de-bonding and foil removal, wafer is turned upside down, plasma cleaning and planarization of the front side

8) Application of a redistribution layer (1 seed layer deposition, 2 dielectric layers, 1 copper layer

9) Balling and singulation





Courtesy of

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Fan-out wafer molding

- Fan Out WLP
  - Cleaning
  - Adhesive film coating

- The carrier wafer is cleaned.
- An adhesive film is laminated onto the surface.

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Wafer Cost per consumable family

Wafer cost per Consumable Family for the medium cost scenario.

Material Name	Material Cost	Breakdown
SF6	$0,06	0,1%
Ti/TiN Target	$0,09	0,1%
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	

Wafer cost per Material Family

- Details of the material cost per step are given in the Excel Spreadsheet.

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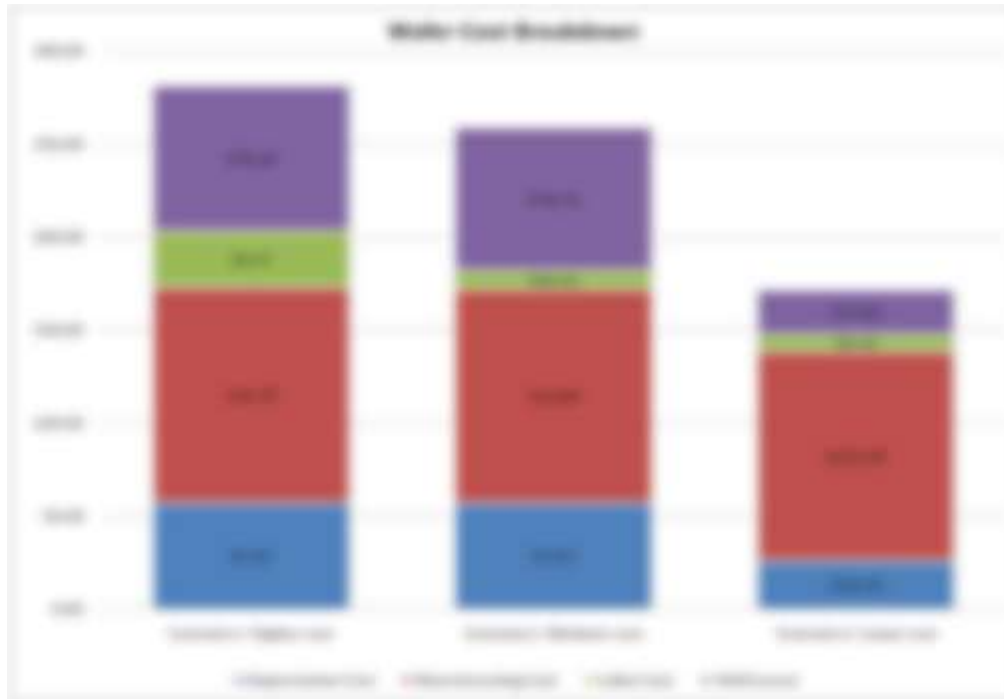
eWLB Wafer Cost

	Scenario 1 Higher cost		Scenario 2 Medium cost		Scenario 3 Lower cost	
	Cost	Breakdown	Cost	Breakdown	Cost	Breakdown
Depreciation Cost	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Manufacturing Cost	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Labor Cost	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STEPS COST	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Die cost	[illegible]		[illegible]		[illegible]	
Yield Losses	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Manufacturing yield	[illegible]		[illegible]		[illegible]	

Wafer cost breakdown



- The main part of the wafer cost is due to the Manufacturing Cost: xx% in the “medium cost” version.
- The yield losses is a major cost factor, up to xx% for the “low yield” versions.
- The depreciation cost around xx% if new equipments are used (Scenarios 1 and 2).
- The labor cost is much higher in Germany (Sc. 1) but the overall weight is only xx%.

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