

# Non Destructive 3D Chip Inspection with Nano Scale Potential by use of Backside FIB and Backscattered Electron Microscopy

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## Abstract

Three dimensional chip inspection with sub micron resolution is essential for physical failure analysis. The established approaches often require cross sections, destroying the device under test. This paper presents a non destructive way to gain precise geometrical information of the transistor- and metal-one-layer with the use of state of the art backside FIB preparation and backscattered electron microscopy.

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## 1. Introduction

Throughout the development of modern Failure Analysis (FA) the chip inspection using a broad variety of microscopy tools has always been very important. With the ongoing technology shrink and the increasing number of metal layers in modern ICs, the use of frontside tools, either light or electron beam based, is very limited. Also other well established methods, based on sonic deflection or X-ray do not offer the required resolution in horizontal and especially not in vertical direction. To check on the geometrical properties of transistors, contacts, metal lines or vias destructive methods like parallel lapping or the preparation of cross sections are mostly utilized. These physical preparations present a great risk to the success of the PFA since the operator has to know very precisely where to end the preparation to make the root cause visible. FIB tools are very successfully used to do cross sections with an accuracy of a few nanometers, but the **Device Under Test (DUT)** will still be dysfunctional. In case of a wrong area prediction the operator might not have a second chance.

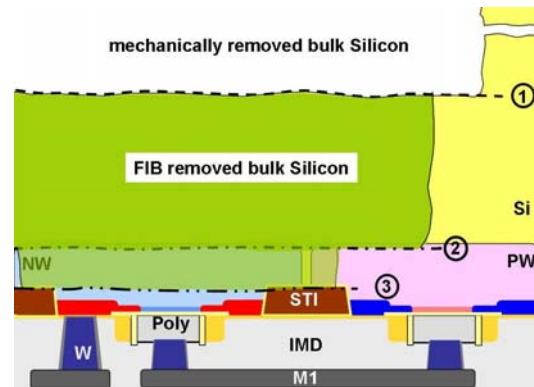


Figure 1: Process Flow of backside CE

The here proposed method offers a 3D inspection of the lowest micrometers of circuitry (including transistor- and M1-layer) with only little impact on circuit performance. The procedure is based on backside FIB preparation where the DUT is locally thinned to Shallow Trench Isolation (STI) level. This process has been discussed in previous publications [1, 2, 3] and will only be very briefly reviewed. The 3D inspection uses **Backscattered Scanning Electron**

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