

Improving Step Cut Visibility by Revolutionizing Blade Combination Design Rule

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I. OVERVIEW

- Automotive semiconductor packages aims for high reliability product due to criticality of its application.
- Nowadays, Step Cut at Silicon wafer sawing process is one of the critical characteristics that have been a requirement. Step cut is an assurance of high reliability die due to the elimination of chipping towards the die surface.
- As shown in figure 1, Step Cut refers to the stepping of silicon die. Stepping of the silicon die is achieved by using two different diamond blade thickness used simultaneously.



Fig. 1. Step Cut Representation

II. PROBLEM IDENTIFICATION

- Step Cut visibility is difficult to attain, the centering between two different diamond blades is critical.
- Currently step cut not visible shown on figure 2, have been prevalent due to the blade thickness variation is becoming larger and machine tolerances are increasing.

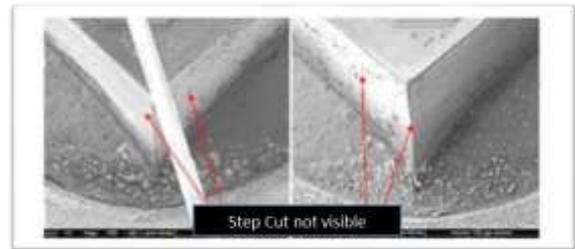


Fig. 2. DAF Sagging or Bleed out

III. PROCESS SOLUTION

- Linear Tolerance analysis shown on figure 3, which with a wafer sawing machine tolerance of $\pm 3\mu m$ and a blade combination design rule of: Z1 and Z2 blade thickness variation of $5\mu m$ will really have a $0.5\mu m$ probability of cutting the Z1 cut.

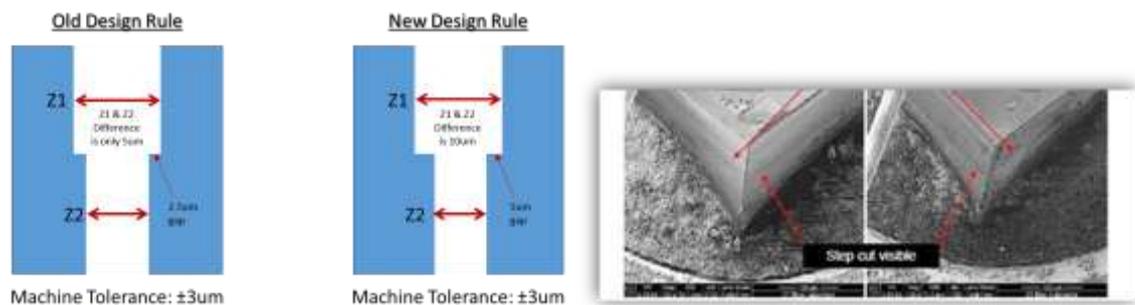


Fig. 3. Linear Tolerance Analysis and Step Cut Visibility

- Revolutionizing the blade design rule of Z1 and Z1 blade thickness variation from $5\mu m$ to $10\mu m$ will increase gap between two different cuts at wafer sawing process even with $\pm 3\mu m$ XY machine tolerance.
- The change of design rule will therefore prevent no step cut visibility and will increase the strength of die and lastly will improve the reliability of the semiconductor package.