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IC Package Design and Process Improvement for Topside Crack of Plastic Encapsulant

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Keywords— *Chip-out; package crack; sidewall; semiconductor package; mechanical blade.*

I. Background of the Study

- Package singulation is the process of separating molded or encapsulated integrated circuit (IC) device into individual units through mechanical dicing blade

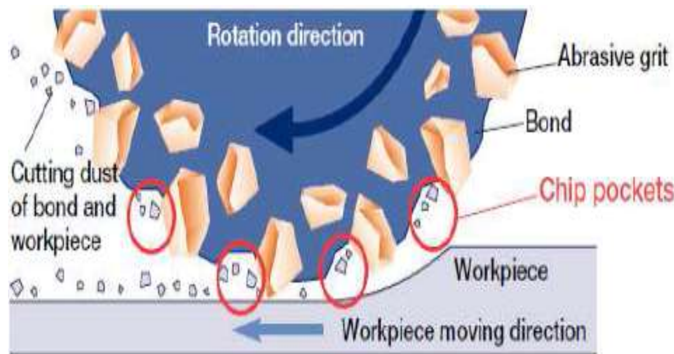

Fig. 1. Mechanical blade process.

- A combination of abrasive grit and bond material on the mechanical blade trims away the silicon and metal material along its chip socket as it moves to the cutting path
- However, abrasive cutting often induced chippings/ chip-outs in the mold material. Worst occurrence of the defect is known in IC assembly process as a potential entry point for delamination to propagate

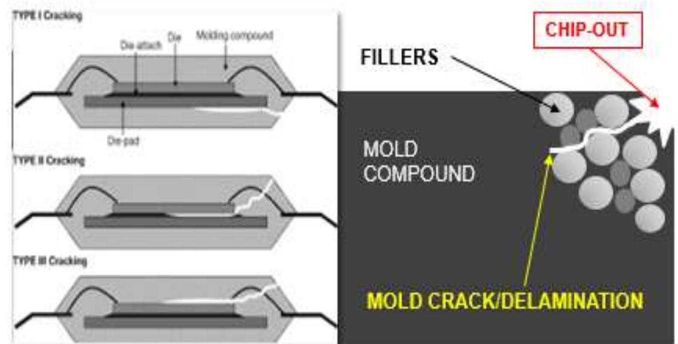

Fig. 2. Illustration of mold crack defects.

II. Package and Process Design Solution

- Topside chip-out/chippings can be improved through modification of the package design and singulation cutting technique
- Option #1, improvement in the package sidewall to produce an indented design – this can be done by modification in the mold chase design at molding process to produce an indented sidewall in the package
- As shown in Fig. 3 during singulation process, the mechanical blade with not touch the topside portion during cutting process
- Option #2, dual singulation cutting includes two cutting process that uses a wider blade for the first cut then a thinner blade for cutting the second half – the idea of this solution is to lessen the load of the mechanical blade during cutting process that will significantly improve the quality of the cut
- The package singulation/cutting improvement in Fig. 3 illustrates the two options in eliminating the topside chip-out/cracks

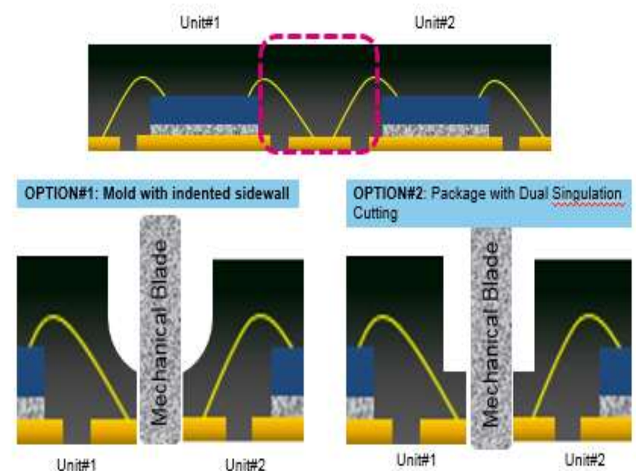

Fig. 3. IC package cutting techniques – options 1 and 2.

- Furthermore, it is highly recommended to consider the placement of the wires versus the location of the indented sidewall in this package and process design improvement