

Mechanical Interlocking Integration for Lead to Mold Interfacial Strength Improvement

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I. OVERVIEW

- Package reliability measures the manufacturing consistency and quality for an individual integrated circuit device.
- A QFN (Quad Flat No-Lead) device may composed of different direct material (leadframe, silicon die, wire, adhesives, molding compound) types and architecture creating dissimilar reliability result for each individual combination.

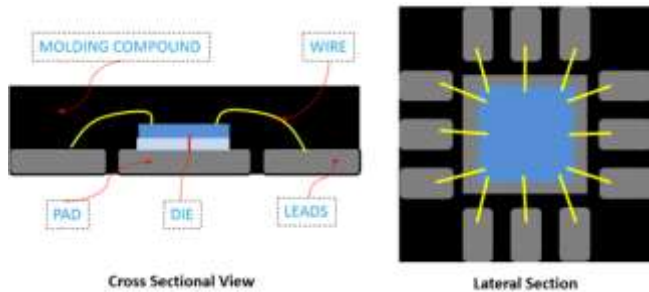


Fig. 1. QFN

- Moreover, the assembly machine and indirect material (blade, capillary, and blade) may also affect the reliability performance of an integrated circuit device.
- During development, the defined combination of material and machine are evaluated thoroughly before it can be transferred to mass production.

II. PROBLEM IDENTIFICATION

- A QFN (Quad Flat No-Lead) device is encountered with delamination issue between mold compound and lead, as shown in Fig. 2.
- Upon “de-capsulation”, the unit is found to exhibit delamination that propagates up to the 2nd bond wire (wiring connection on the lead), as shown in Fig. 3.



Fig. 2. X-ray Photo

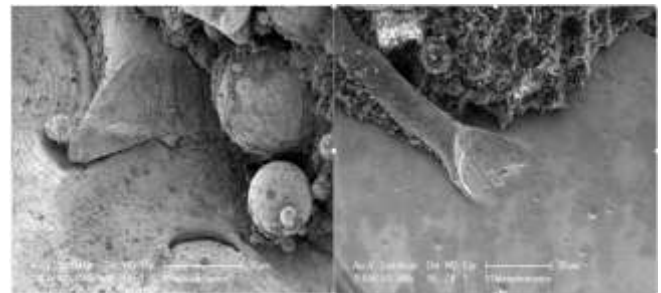


Fig. 3. Delamination

- The functionality of the device is affected by the occurrence of delamination.

III. PROCESS SOLUTION AND IMPROVEMENT

- Modification in the current design of leads is proposed to increase the mechanical strength of mold compound and lead through integration of “interlocking” design.

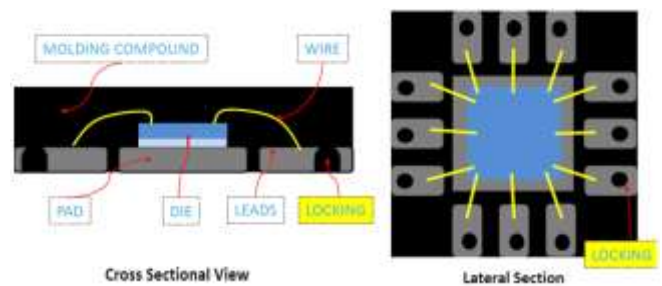


Fig. 4. QFN + Interlocking

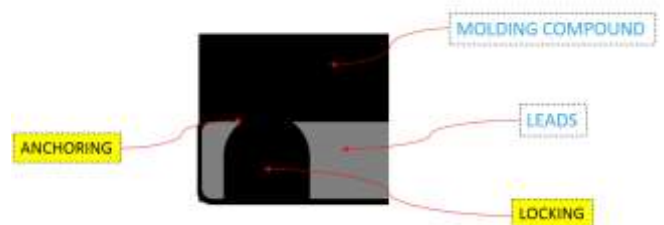


Fig. 5. Locking design

- Etching or mechanical process such as drilling can be used to create the interlocking design during leadframe fabrication.
- A mechanical anchoring is produced by the interlocking design.