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Process Improvement Through Modification of Overload Sensor in Singulation Station

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I. Overview

- Singulation process in semiconductor assembly manufacturing is a process typically performed to separate integrated circuit packages such as IC chips from a substrate / leadframe in order to form the individual units.
- Package crack is one of the top rejects at package singulation process and this trigger to have a big impact affecting process yield of the product lot.
- Illustrated in Fig. 1 is the Assembly process flow of QFN (Quad Flat No leads) and as enclosed by a red dotted line is the process where rejects occur.

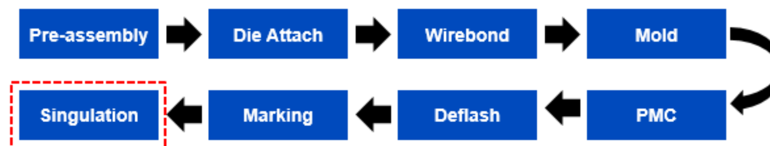

Fig. 1. Assembly process flow of QFN (Quad Flat No leads).

II. Problem Identification

- During lot processing at package singulation, package crack manifest which induces assembly reject that contributes to a yield lost. This is caused by overshoot leadframe pusher that resulted to a molded leadframe misalignment on the specified location. During picking of leadframe, the dowel pin touches the leadframe resulting to a package crack defect.
- This issue was encounter at singulation process and was identified through robust evaluations and process mapping as well to detect the main root cause of the issue and this will also be seen on the reliability of the package and leakage as well.
- Illustrated in Fig. 2A Actual molded leadframe pushed on the rail track and Fig.2B Exceed on the rail track location and as shown in Fig. 2C is the actual failure mechanism.

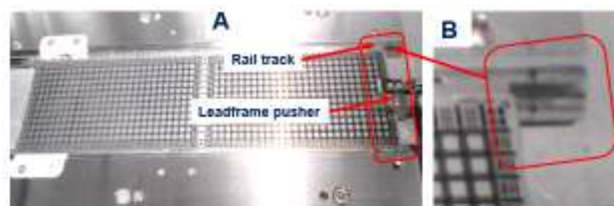

Fig. 2A Actual molded leadframe pushed on the rail track/Fig.2B Exceed on the rail track location.

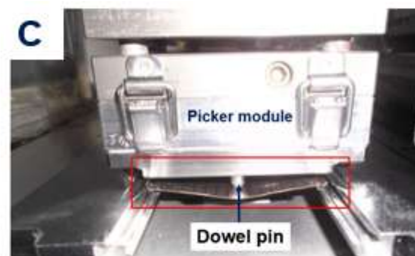

Fig. 2C Actual failure mechanism.

- The occurrence of package crack on molded strips at singulation process will be tag as reject since this will not be properly singulated into individual pieces.

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III. DESIGN SOLUTION

- A lot of suggestions and ideas resurface to address the issue of package crack such as moving the product to other machine but with higher cost involve. Likewise, qualifications of other machines are too difficult since a lot of data is needed to complete the qualifications.
- However, machine improvement was explored by adding overload sensor to fix the issue of package crack. See Fig. 3 below.

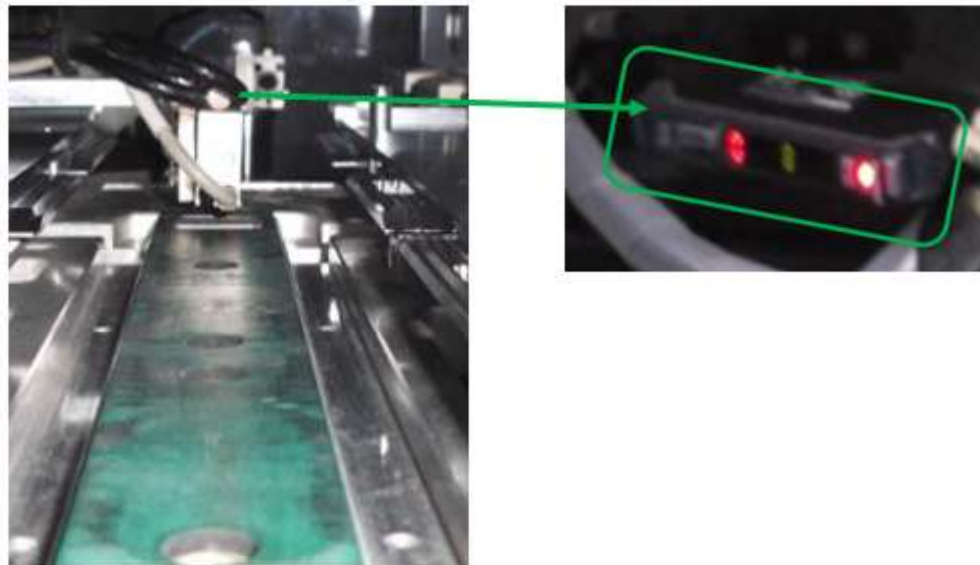

Fig. 3. Additional overload sensor

- This additional overload sensor will eliminate the occurrence of package crack and this will have a better reliability response and no leakage found on the samples. With this solution, the yield is already address and we can guarantee that no units will shipped to our end customers that has a manifestation of package crack issue.