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Enhanced Wirebond Process Plate for Reduction of Non-Stick on Leads on Leadframe Device

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I. Background of the Study

Quad-flat no-leads (QFN) is a type of leadframe device in semiconductor industry wherein the silicon chip or die is mounted on leadframe pad through a die attach glue or film. One option for the input/output (I/O) signals from the silicon die are then connected I/O leads through wirebonding process. During package development stage of a standard QFN product, one major challenge needs to address is the bouncing of leads during the wirebonding process on a no-tape leadframe. A typical assembly process flow is given in Fig. 1.

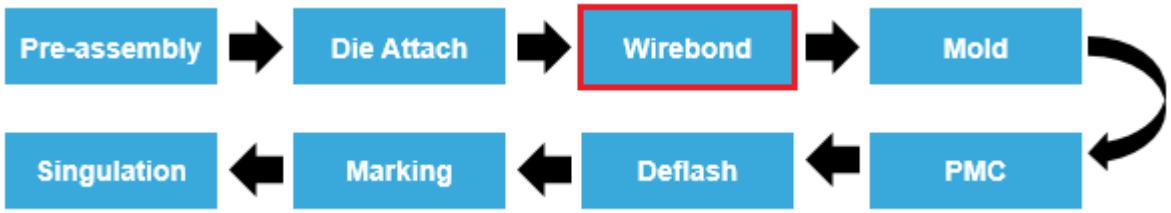

Fig. 1. Assembly process flow of standard QFN package.

II. Problem Identification

Leadframe bouncing was frequently encountered during wirebonding. This problem has high assembly manufacturing rejects during lot processing. The issue is mainly caused by a wirebonding panel-type top plate or process plate shown in Fig. 2a. The purpose of the panel-type process plate is to grip the leadframe in the panel during the wirebonding process. Unfortunately, since the leadframe is warped, the process resulted to defects particularly non-stick on leads (NSOL) and non-stick on pads (NSOP) shown in Fig. 2b. This indicates that the 2nd bond and 1st bond of the wire were unable to stick on the lead finger of the leadframe as well as on the silicon die bonpad. This needs to be addressed as it affects the manufacturability and reliability of QFN products.

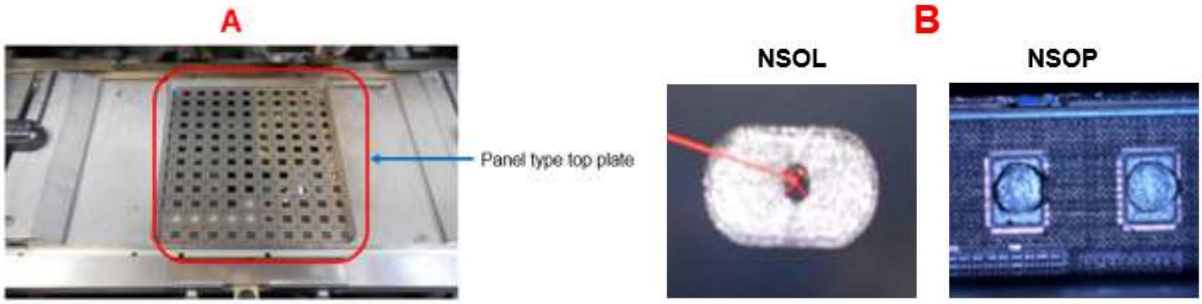

Fig. 2. a) Actual panel type clamp, b) Assembly manufacturing reject.

III. Process Development Solution

An enhanced and specialized process plate design was developed for the specific QFN leadframe device, for wirebond assembly process. With the individual clamping alignment per leadframe column, it eliminates the occurrence of assembly manufacturing rejects namely NSOL and NSOP. Fig. 3a shows the improved process plate design, and Fig. 3b the actual stitch and ball formation with the improved process plate used. It can be observed that the stitch and ball formation is improved, compared when using the previous panel-type clamp.

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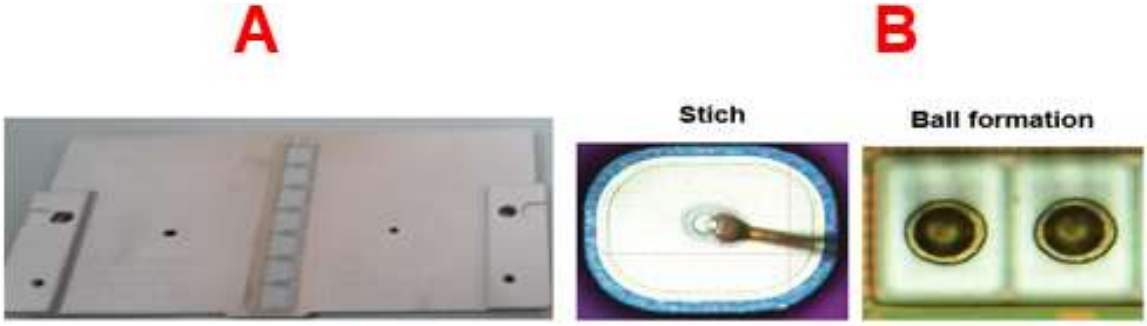

Fig. 3. a) Enhanced process plate design, b) Actual stitch and ball formation improvement.

Performance of the enhanced process plate design in terms of PPM level of assembly rejects has greatly improved as highlighted in Fig. 4, significantly reducing the occurrence of assembly rejects particularly NSOL and NSOP.

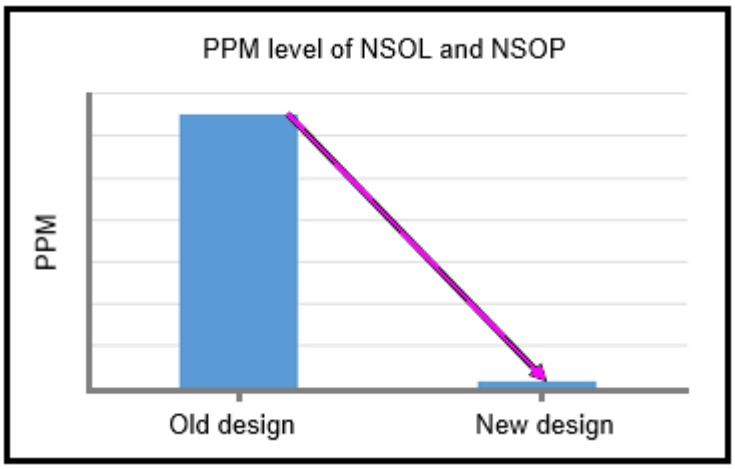

Fig. 4. PPM level performance (actual values intentionally not shown).