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Elimination of Non-stick on Leads Defect through Re-designed WCTP

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This paper presents the reformation and fabrication resolved on the wire clamp and top plate (WCTP) design to eliminate the presence of lead finger bouncing resulting to high rejection of non-stick on leads (NSOL). Problem experienced was that the hollow or half-etched portion of the leadframe at the top and bottom units caused its bouncing effect. With the aim to improve localized massive NSOL defect, WCTP has been modified to provide positive bias to support its hollow part or the half-etched part of the leadframe at the top and bottom of the units. The re-designed WCTP was fabricated, extending its clamping with enhanced vacuum on top and bottom rows. The implementation of the improved WCTP design reduced the defect with 88 % improvement with the defect reduction during the lot runs.

Keywords: Bouncing; non-stick on leads; wire clamp and top plate; wirebond.

1. INTRODUCTION

From a manufacturing standpoint, wirebonding parameters portrays a critical role in bond formation and bond quality. Parameters such as bond force, bond time, temperature, loop geometry and other auxiliaries can have a significant effect on bond quality. Aside from the

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parameter optimizations, machine capability selection and tooling like wire clamp and top plate is a substantial setup to good wirebond performance.

Typical defects encountered at wirebond station are lifted stitch or non-stick on leads (NSOL), non-stick on pads (NSOP), and the presence of contamination or foreign material, plating defects, cut wire and missing wires, among others. NSOL has been categorized as the top defect detractor of dual-flat no-leads (DFN) packages. NSOL happens when the interface between the carrier leadfinger and its stitch is not robust enough to stand the forces acting upon the interface. Several factors affect its bonding formation either via parametric or mechanical influence [1-5].

Lot to process mapping was executed to investigate the reason behind high rejection of NSOL. Based on recognized evidence, bouncing effect was observed during formation of wire or when the capillary puts force to the silicon die (bonding pad) during the formation of intermetallic between wire and pads. Also, localization on top and bottom is clearly isolated case that all lots has been affected.

The hollow part or the half-etched portion of the leadframe has been illustrated in Fig. 1 wherein mostly the leadframe bouncing was manifested. Fig. 2 shows the actual location of NSOL occurrences on top and bottom location. Works and learnings in [6-12] related to the wirebonding process are helpful in this study.

Fig 3. Illustrates the previous WCTP tool used during production run. Insert has no positive bias, no vacuum on top and bottom rows and extended clamping.

2. METHODS, RESULTS AND DISCUSSION

The key parameters optimization is not enough for a reliable and good bond formation during wirebonding. Instead, proper equipment and tools are also necessary on the target performance. It has been correlated during validation that NSOL occurrences have significant massive localization where WCTP design being the root cause of leadframe bouncing. Defect manifestation is being consistently seen on upper and lower edges on the window clamp. Focusing on the tool improvement where abnormality has been observed, modification on the WCTP has been fabricated. The re-design aids to resolve the localized NSOL occurrences during wirebonding.

An additional clamping extending it on top and bottom ensures no bouncing effect may occur during wirebonding. It has been designed also the insert with positive bias makes it more significant to support the half-etched part of the leadframe on top and bottom of the units. The WCTP design with positive bias is shown in Figs. 4 to 5.

The new and improved WCTP has been validated effective during initial production run attaining an 88 % reduction of NSOL occurrence from the previous parts per million (ppm) response level. Fig. 6 shares the ppm performance improvement in terms of NSOL reduction.

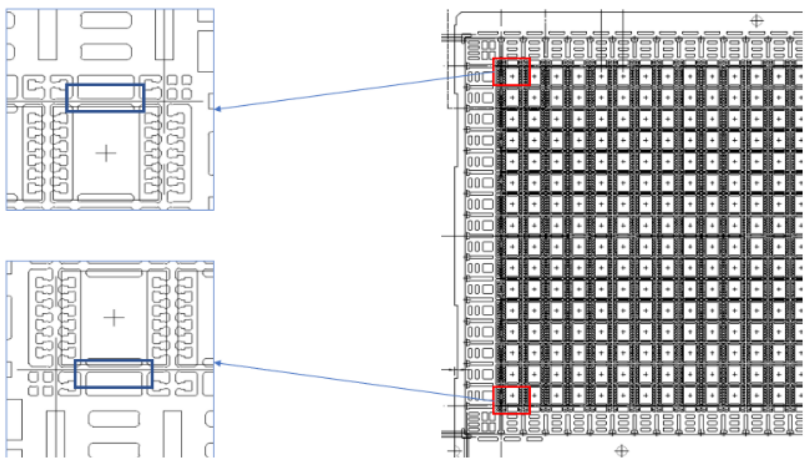

Fig. 1. Hollow or half-etched part of the leadframe (at top and bottom units)

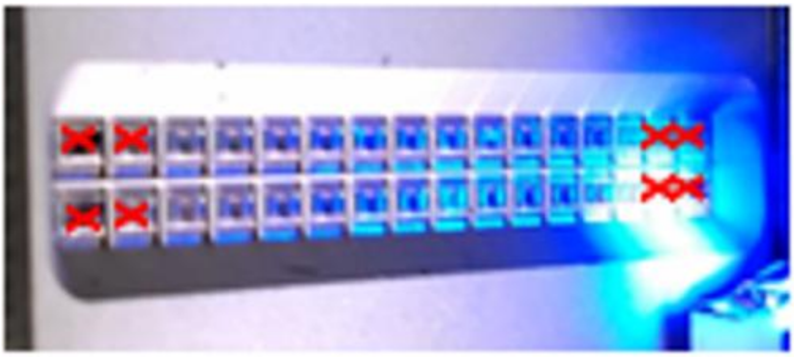

Fig. 2. Localized NSOL (top and bottom)

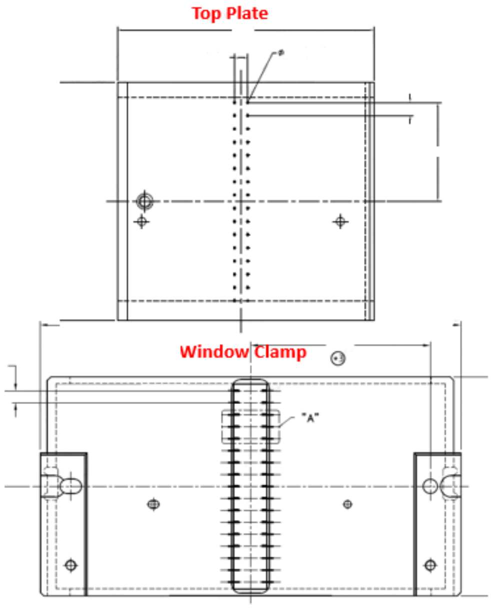

Fig. 3. Current WCTP design

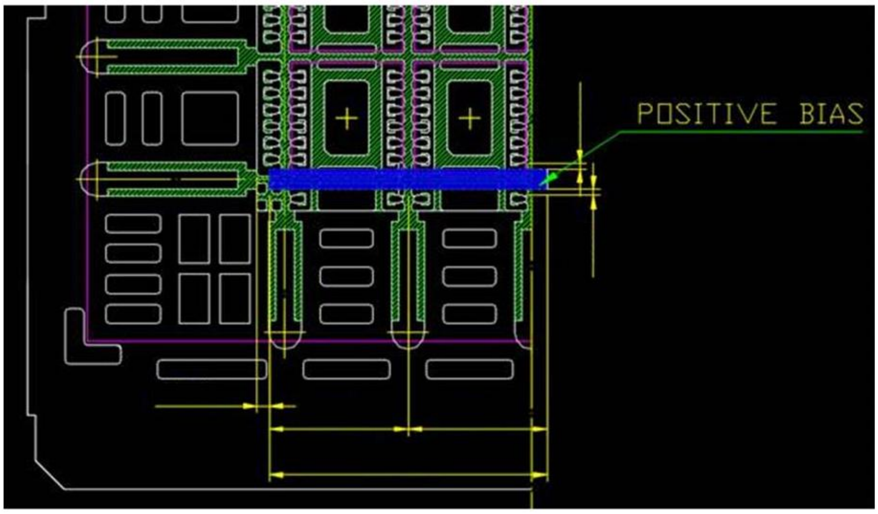

Fig. 4. WCTP design with positive bias

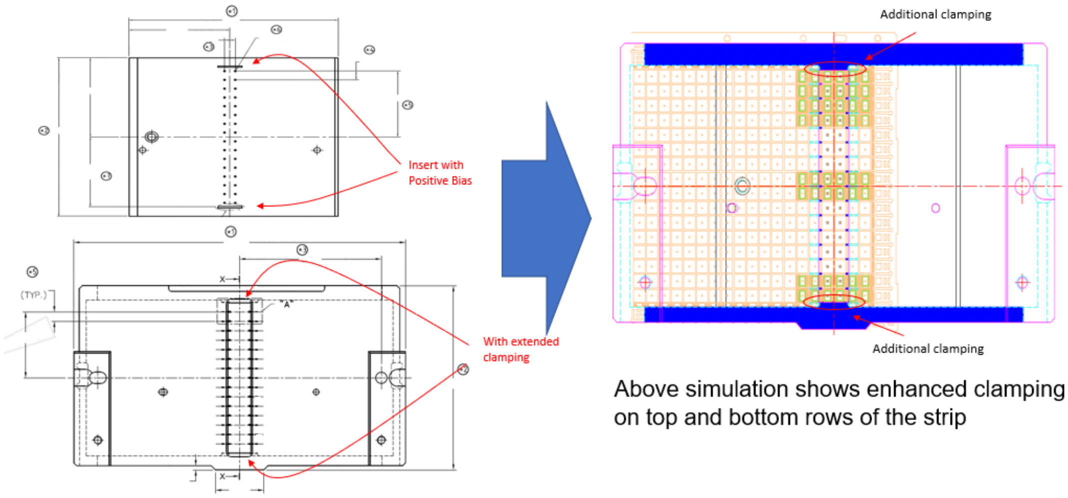

Fig. 5. Improved WCTP with positive bias on insert and extended clamping

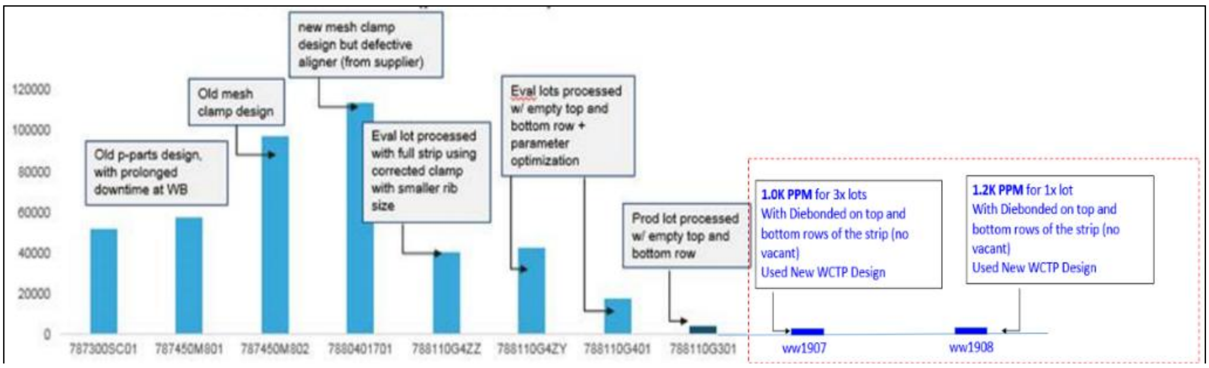

Fig. 6. Ppm level of NSOL defect

3. CONCLUSION

There are various ways in which the bond pad quality can be influenced. Both materials and process related at key contributors on the wirebond yield performance. This paper presented a process resolution and tool modifcation with the improved wire clamp and top plate, which significantly reduced the NSOL ppm level occurrences during assembly process. With the vacuum enhancer on top and bottom rows, inserting positive bias, and extending its clamping, the new WCTP offered a better stitch formation that appropriately bonded on the hollow or half-etched portion of the leadframe.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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