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Improvement on QFN Leadframe Design of Extended Leads to Support the Mitigation of Mold Flash Occurrence

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Authors' contributions

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

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ABSTRACT

Parameter optimization is not only the key to find the most favorable and best solution as variable chances of failure modes may happen at extreme case conditions at unexpected period. Packaging design robustness is much resilient to establish a satisfactorily good quality product and sustain a long-term goal of a remarkable process capability. This paper presents leadframe design solution of quad-flat no leads (QFN) to address mold flash defect caused by leadframe bouncing during wirebonding. An inverted pyramid configuration was conceptualized to provide better stability than the standard configuration during wirebonding process and other concerned assembly processes due to the shift of the center of gravity moving closer to the full metal part.

Keywords: Extended lead design; inverted pyramid; leadframe bouncing; mold flash; QFN.

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1. INTRODUCTION

Stringent semiconductor products vary with different leadframe designs per customer specifications requirement and applications. Semiconductor packaging technology solutions characterizes diversified form and fit function as these applications are barely with high integrity and reliability commitment to consumers. With the relentless technology trends and breakthroughs, challenges in assembly manufacturing are inevitable [1-5]. Design of experiments (DOE) are necessary for those with different wafer technologies nor different materials to perform on a specified equipment. Its window parameter ranges are consuming days to months period establishment. Neither the tools to be used, it would be recommending a lot of validation to be executed to arrive the best solution that would fit an optimal result. On top of the evaluations, innovation to materials is a key to product strength to cater all means of potential shifts through time. Given the optimized parameter solution, the need to sustain material supplier capability to meet the customer requirements without sacrificing the product quality. As such, maximizing the capability with respect to process window will help the product achieve process performance key process indices.

Mold flash defect manifestation shown in Fig. 1 is induced after molding station which was significantly affected by potential leadframe bouncing at wirebond. The positional mold flash manifestation had been observed as related to the window clamp and top plate critical location during wirebonding.

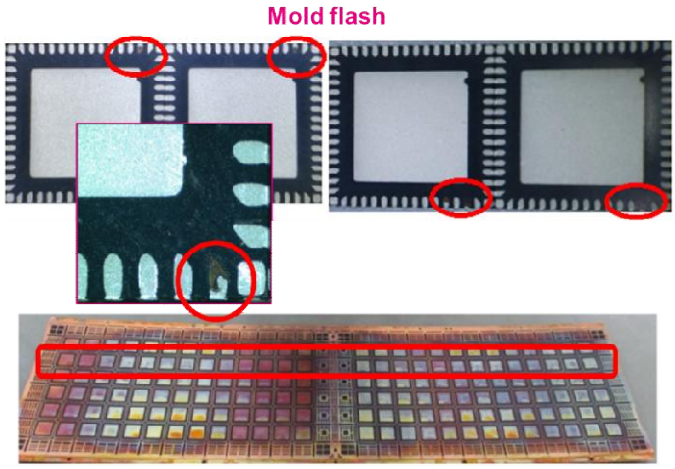

Fig. 1. Mold flash defect manifestation

2. PACKAGE DESIGN IMPROVEMENT

A new design of QFN leadframe with extended leads (etched part) of inverted pyramid configuration would provide better stability than the previous (typical) configuration during wirebonding process and other concerned assembly processes due to the shift of the center of gravity moving closer to the full metal part. The conceptualization of different extended leads design is presented in Fig. 2.

Fig. 2. Extended lead design options

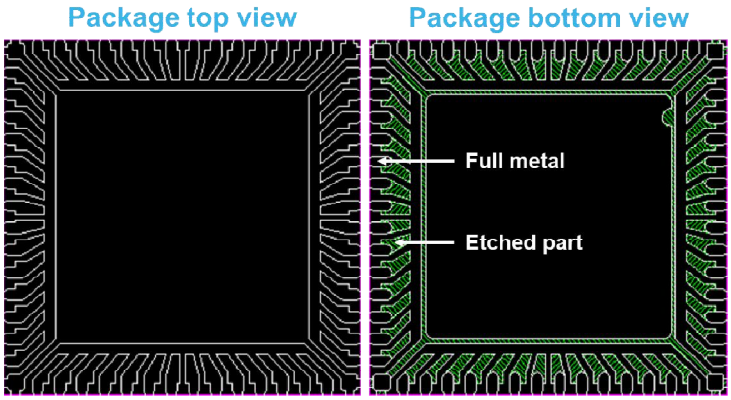

Fig. 3. Package outline

Herewith in Fig. 3 is the unit level representation of package top and bottom view of a leadframe with extended leads. The package footprint or outline is unchanged since the improvement is focused on the etched part which are the extended leads.

3. CONCLUSION AND RECOMMENDATIONS

The paper focused on the improvement of new QFN leadframe design providing different extended lead design options. The new design will offer a better stability than the existing leadframe configuration during wirebonding, tape frame attach and molding process due to the shift of the center of gravity moving closer to the full metal part. This capability design solution will provide the wirebond equipped by process optimization and prevent machine set-up issues.

DOEs can be explored and optimized to meet the desired best solution for the specific product affected with extended leads. Continuous process and design improvement is important to maintain the high-quality performance of semiconductor products and its assembly manufacturing. Prototypes are helpful for future works to validate the effectiveness of the specialized QFN leadframe design on actual devices. Comparison of existing works and other studies could also be included for added analysis. Discussions and works shared in [6-11] are useful in reinforcing robustness and optimization of package design and assembly processes.

DISCLAIMER

The products used for this research are commonly and predominantly used products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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