# Epoxy Fillet Height Study of Tapeless QFN Leadframe Package on Different Diebonders

## ABSTRACT

The paper focused on the evaluation of quad-flat no-leads (QFN) device in tapeless leadframe technology on different diebonder platforms to achieve an acceptable fillet height performance. The study was narrowed down into two main machines with the objective of attaining a fillet height of less than 75 % for small die. Eventually, the fillet height requirement was achieved by both diebonder platforms, hence, these machines could be used for future works on devices with similar requirement.

*Keywords: Diebond process; fillet height; glue; QFN.*

## 1. INTRODUCTION

Packaging technologies for semiconductor products are continuously being developed and improved to provide high quality and reliable products for various applications such as in automotive, medical, communications, and consumer markets. General focus for semiconductor device manufacturers is to increase the production yields and maintain the high-quality performance, while minimizing the assembly rejections and wastage. It is a common knowledge that with these continuous technology trends and breakthroughs, challenges in assembly manufacturing are inevitable [1-5]. In this paper, a QFN device in tapeless leadframe platform is identified to be critical due to the high occurrence of epoxy glue voids as shared in Fig. 1. Voids or gaps inside the adhesion material particularly the glue is created before and/or after the diebonding process cycle.

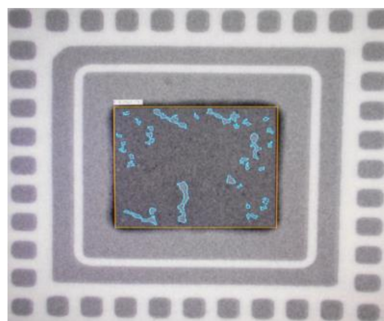

**Fig. 1. Presence of epoxy voids in the device**

## 2. LITERATURE REVIEW

A recommended solution for this issue is to evaluate and characterize a higher target bond line thickness (BLT) for small die to create clearance for the shrinkage of the glue, while maintaining an acceptable epoxy fillet height. The studies and works done in [6-8] were

34 focused on the effects of BLT, transfer pressure, and dispense needle size on the epoxy
35 voids performance. One main challenge raised is the current capability of each machine
36 platform in bonding a small die with fillet height specification. This paper discussed the result
37 of evaluating different diebonder platforms to achieve an acceptable fillet height.
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39 Die attach epoxy fillet height is an excess die attach adhesive rising on the sidewall of the
40 silicon die during the die bonding process. The simple purpose of fillet height is to provide
41 anchoring and mechanical strength along the sidewall of the silicon dies. In addition, fillet
42 height is a very important response because this serves as a guard on the die in order not to
43 trap gaseous element inside the unit or in die attach terms: epoxy voids. The fillet height is
44 being measured as the percentage of the die attach epoxy volume height or thickness
45 (denoted as B) in relation to the die thickness plus the die attach thickness (denoted as A) as
46 illustrated in Fig. 2.
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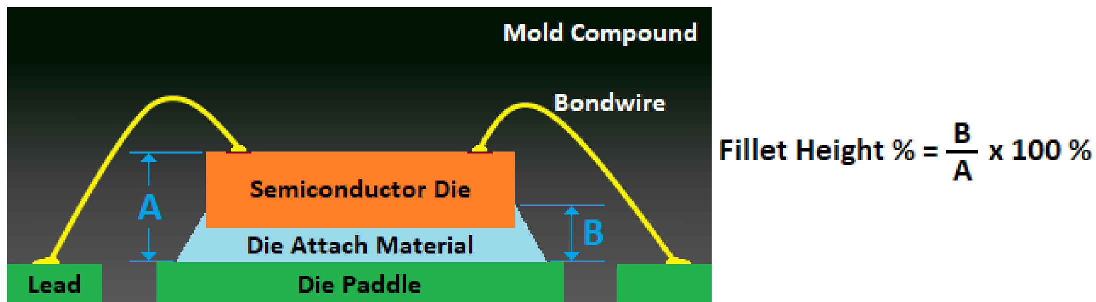


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49
50 **Fig. 2. Measurement of fillet height reference**
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## 52 3. METHOD AND RESULTS

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54 Epoxy fillet height was evaluated in the design of experiment (DOE) on two different
55 diebonder platforms. Note that the fillet height criteria are governed by internal specification
56 and work instruction. Diebonder 1 is has dispensing technology of volumetric dispense.
57 Machine 2, on the other hand, has a pneumatic dispensing technology wherein the
58 personnel can control the volume of epoxy through pressure. Fig. 3 shows the data
59 gathering flow done during the study.
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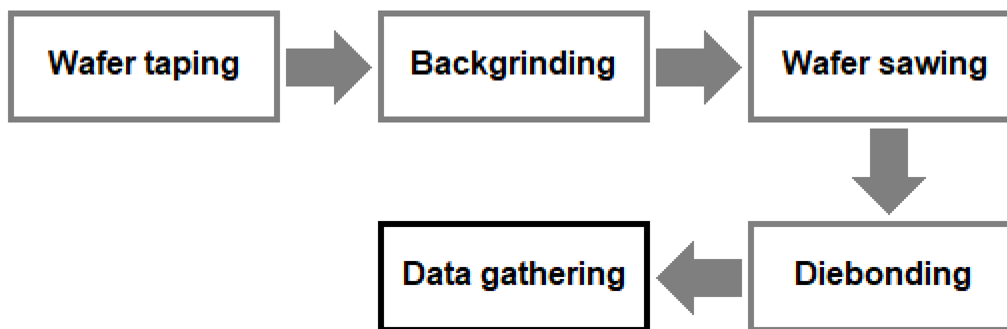


61
62
63 **Fig. 3. Data gathering flow**
64
65 The results given in Table 1 showed that the two diebonder platforms achieved the fillet
66 height requirement as specified in the internal specification document. This indicates that

both machines could be used on the device in focus and on other QFN devices with comparable configuration.

**Table 1. Epoxy fillet height evaluation result**

| Evaluation | Machine | Fillet Height | Remark |
| --- | --- | --- | --- |
| 1 | Diebonder 1 | < 75 % | Passed |
| 2 | Diebonder 2 | < 75 % | Passed |

## 4. CONCLUSION

The paper discussed the evaluation of different diebonder platforms to realize an acceptable epoxy fillet height given the small die setup. The study had shown that both Diebonder 1 and Diebonder 2 machines could process the device at die attach process with fillet height maintained at less than 75 %. For succeeding works and studies, both machines could be used to process other devices with similar configuration or requirement. Studies and learnings shared in [9-11] are helpful to improve the die attach process. Moreover, works and studies in [12-14] are helpful in realizing a robust assembly manufacturing process.

## ACKNOWLEDGMENT

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