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Chopper Cut Set-up: Breakthrough Approach for Blade Height Accuracy

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Abstract**—** *Semiconductor packages has become dynamic in terms of application and its package architecture. Packages were designed to become thinner and with advance capability. In lieu to the need of thinner packages, its architecture has changed to adopt the requirement. Dicing before grinding have been developed to cater thinner dies. Dicing on a full wafer thickness needed an accurate blade height. In addition, new processes such as partial cutting prior package Singulation have been developed to adopt to the emerging needs of higher bond level reliable products. Similar to dicing before grinding, partial cutting needed an accurate blade height. In order to achieve accurate blade height, process solutions such as chopper cut set-up have been introduced.*

Keywords**—** *Chopper Cut Setup; Blade Height; Dicing Before Grinding; Partial Cut; semiconductor package; process solutions*

I. INTRODUCTION

Nowadays, Semiconductor packaging requires innovative solutions. There were several changes on the architecture have been introduced such as thinner package height and new lead design, such as Wettable Flanks. The paper introduces an innovative process solution to cater the emerging changes on semiconductor packages. Accurate blade height is needed to ensure the accurate depth for dicing before grinding and partial cutting for Wettable flanks.

Dicing before grinding or DBG is a process to cater thin wafer Backgrinding with minimize stresses during the actual process to eliminate wafer crack prevention and good backside chipping and die strength. One critical process of DBG is Half Cut [1] wherein blade grooving has done in thick wafer status. In full die thickness sawing, one of the critical parameters was blade height since top side chipping risk is decreases once optimized [2]. Since typically wafer have high thickness variation, grooving should be very accurate, since DBG is designed for 50um die thickness. After the grooving, wafer that is partially diced which is protected by a back grind tape and will finally separate into individual dies once grinded.

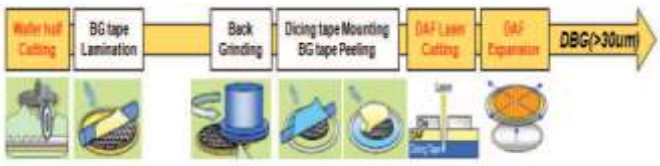

Fig. 1. Die Attach Epoxy Adhesive [3]

One emerging technologies on the Quad Flat No Leads or QFN package is Wettable flanks technology. QFN is one of the several package technologies that connect to the Printed Circuit board without through holes [4]. However, nowadays, automotive industries have requested to have QFN with better board level reliability performance. In lieu to the new requirement, Wettable flanks offers a concave space wherein solder will strongly adhere to the edge of the package. The concave space on Wettable flanks process is a result of highly accurate laser surface detection for the partial cut process [5]. Afterwards, plating will be performed before the full mechanical package Singulation, see figure 2. Both partial and full package Singulation have the same system and have the process in both strip form.

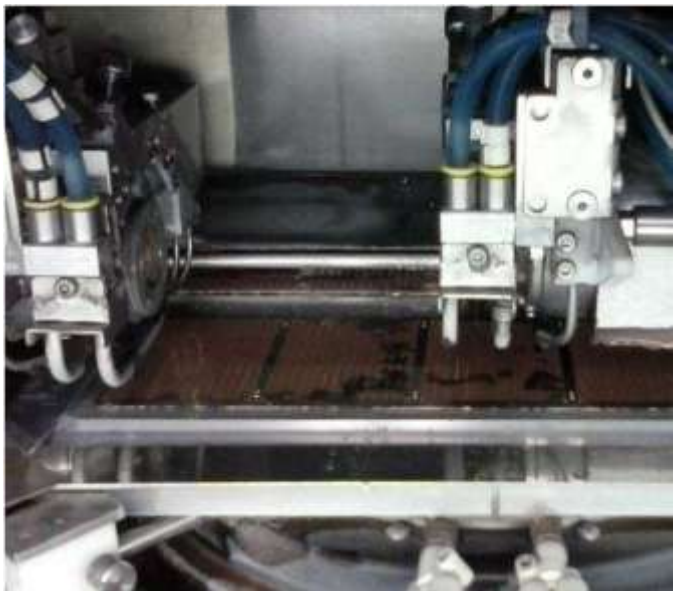

Fig. 2. Mechanical package singulation

Both Half Cut of Dicing before Grinding and Partial Cut of Wettable flanks still encountered problem that normally found on mechanical dicing, which is blade wear. The typical blade height monitoring using a non-contact surface detection have limitation in measuring the proper blade wear that occur during the process. The paper will discuss the introduction of a new process of measuring the blade wear out to attain accurate blade height that is needed to maintain blade groove for DBG and precise QFN package partial cut for Wettable flank technology.

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II. PROCESS SOLUTION

The innovative process solution, shown in figure 3, offers accurate blade height. The typical blade height of non-contact surface detection, only offers measurement of blade wear depending on blade tip. The old method of blade wear detection is very prone of misdetection of remaining blade height and blade wear. Due to its limitation, non-contact surface detection has high variation of blade height and not appropriate for the half cut and partial cut method for DBG and Wettable flanks, consecutively. The new method is called chopper cut set-up or CCS. The new method have introduced a Silicon calibration chip wherein the measurement will happen. The blade with perform half cut on the Silicon calibration chip with a predetermined cutting depth. The system will measure the cutting length and will measure the supposed actual cutting length versus the predetermined cutting depth. The chopper cut set-up will correct the difference between the two measurements. The new method of measuring the actual cutting length and its comparative method to the supposed actual cutting depth makes it more accurate. The new method also mitigated the risk of misdetection of blade wear and can latter affect the blade height measurement. Thus, chopper cut set-up is the appropriate blade height measurement system for new technologies such as Half Cut for DBG and Partial Cut for Wettable Flanks technology.

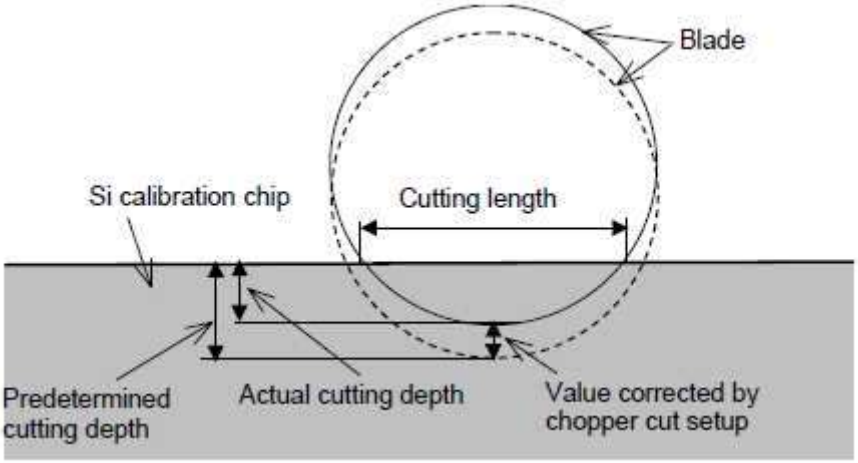

Fig. 3. Chopper Cut Set-up [6]

III. CONCLUSION

The innovative solution offers more accurate blade wear detection, which make it an appropriate process control for more accurate process requirement of blade height. Chopper Cut set-up have more blade wear measurement with the introduction of a Silicon calibration chip and systematic measurement of cutting depth versus the actual cutting length. The new solution make its more appropriate for high precision process such as half cut for dicing before grinding and half cut for Wettable flanks.

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