

Die Attach Machine Innovation by Module Modification to Address Leadframe Rejection on Quad Flat No Lead Devices

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Abstract— Quad Flat No Lead devices of semiconductor industry has been one of the highest demand products for industrial and commercial market for different applications. In die attach process of such product, high yield and elimination of unit rejections are some of the main factors to have a robust and efficient process through innovation, modification, and integration of instruments. Crumpled and damaged leadframe defects are some of the defects that needs to be addressed. Factors causing these rejects such as mechanical movements and overshooting during transfer to output module are observed and should be mitigated to prevent the said phenomenon. This manuscript will discuss the said topic, how it occurs and the modification to correct and prevent the unwanted product rejections.

Keywords— Automatic Rotary Hinge, Die attach, Leadframe, Output magazine, Semiconductor, Stopper

I. INTRODUCTION

The present world introduces innovation and modernization as we emerge to recent technologies on all field of industries. Improvements on manufacturing plants as cited on [1-3] like robotic applications, Internet of Things, and process automations are considered. This is to sustain plant efficiency, enhance productivity, and maintain elevated level of quality. On the semiconductor industry all of this are considered to have a world class products and satisfied customers. Die attach of Quad Flat No Leads or QFN's on semiconductor field is one of the critical processes in manufacturing integrated circuits. This process uses sawn silicon wafer, turned into die, and picked up by the machine to be placed on the Leadframe as base. Die attach adhesive is also used to secure the attachment and processed units undergone oven curing.

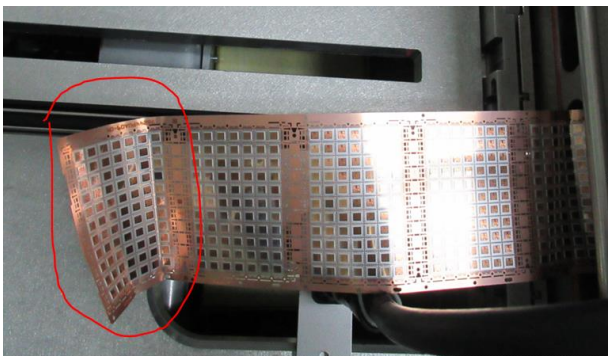


Fig. 1. Crumpled leadframe caused by collision on a machine part

During processing of die attach, challenges are inevitable causing product defects, process inefficiency and worst

customer complaints. One issue is the crumpled and damaged leadframe defects caused by unwanted collision of leadframes on part of the machine, specifically on output module. Fig. 1. Shows damaged leadframe after collision resulting to gross unit rejection of die attach parts. Currently there are no mechanism to protect these leadframes from protruding after die attach process.

II. PROBLEM IDENTIFICATION

The output module of die attach machine consist of main parts: Output magazine, Output elevator, Output magazine platform for loading of blank magazines and unloading of full magazines, and Side panel covers as shown on Fig. 2. After die attach sequence, the completed leadframe will transfer to the output magazine by means of output indexer gripper and mechanical rollers. The leadframe will then settle on the output magazine until full and will be unloaded by the output elevator going to the unloading output magazine platform. Blank magazine will be loaded by the output elevator and the cycle will continue unit all leadframes are completed on the die attach process

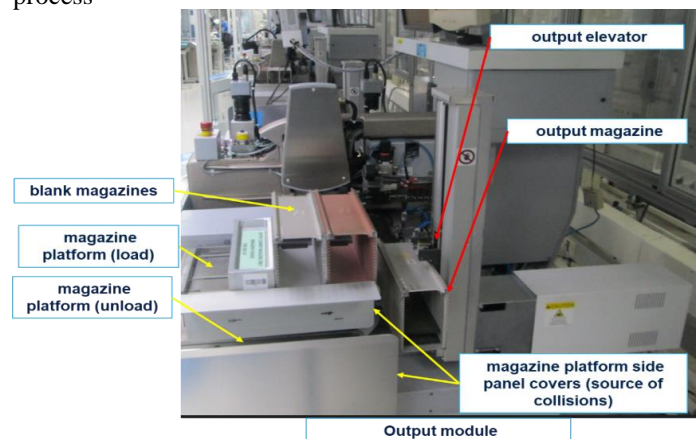


Fig. 2. Output module parts with label

In the process of leadframe transfer to output magazine, leadframe exceeds on the magazine dimension and collide with other parts of machine. This is caused by inevitable mechanical movement during process (i.e., vibrations) and mechanical transfer movement of output motor roller. Due of these movements, processed leadframe protrudes from the magazine and collides on the side cover of the machine. this makes it vulnerable to collision and worst, may have fall from the

magazine. Fig. 3. Shows the actual condition of protruded leadframes colliding on the side rails causing defects.

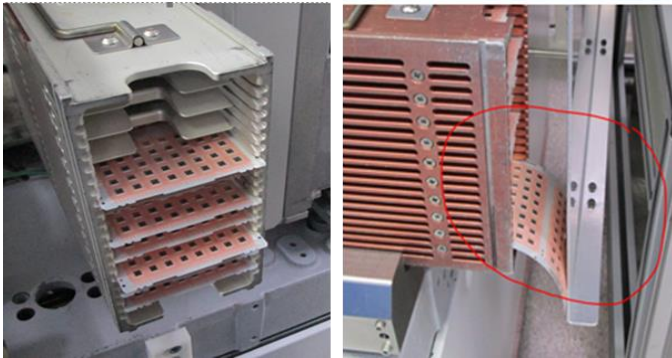


Fig. 3. Image of leadframes protruding outside the magazine (left); and Actual protrusion of LF's colliding to side panel cover (right)

III. PROCESS IMPROVEMENT

To resolve the said issue on output module, an integration and modification, similarly cited on [4-6] is conducted and simulated to have a stopper that will prevent the unwanted protrusion of leadframes during processing. This is the Automatic Swing-type Output Magazine Handler Stopper, installed on the output module. The Automatic swing type output magazine handler stopper is a mechanical instrument fabricated to serve as closure of output magazine to prevent leadframes from protruding during die attach. It is attached on the side of the output elevator by means of mechanical screw, and movable in swinging direction by means of mechanical screw, and movable in swinging direction for the operator to access these leadframes during in process inspection. Figure 4.1 and 4.2. Shows the assembly and parts of the Automatic swing type output magazine handler stopper in open and close position respectively:

- A. Stopper bar – the part of the automatic swing arm stopper with contact to LFs that prevents the protrusion.
- B. Automatic Rotary Hinge (ARH)– a gravity-actuated rotary hinge that automatically moves the arm in a swing motion and puts the stopper on its original position.
- C. Magnetic dowels– guides the swing arm and ensures it in the rest position thru a magnet.
- D. Swing arm– a 90degree arm that holds the stopper bar and latched on the ARH

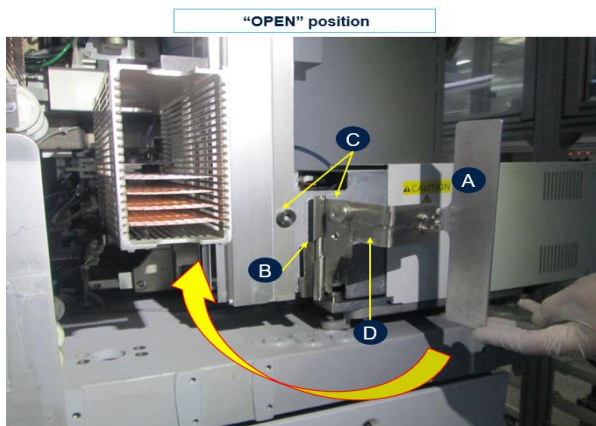


Fig. 4.1. Automatic swing type output magazine handler stopper in "open" position

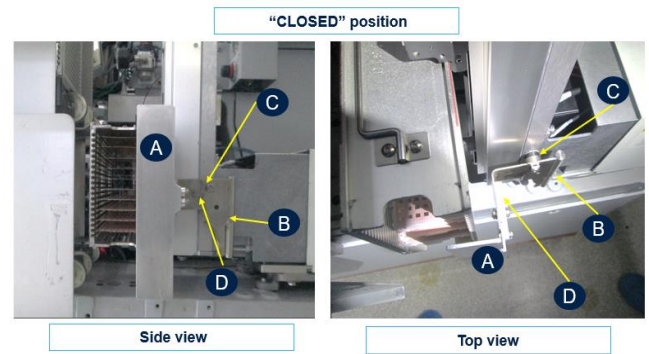


Fig. 4.2. Automatic swing type output magazine handler stopper in "closed" position

The main highlight of this innovation is the automatic mechanism feature of the stopper, with the mechanical movement of the Automatic Rotary Hinge or ARH. The ARH is designed for the swing arm to revert to its resting position (closed) without the use of any electrical instrument, sensors, or any other complicated part. As seen on Fig. 5., The rotational movement of this hinge is actuated by the spiral design and gravity by the combined weight of the swing arm and stopper bar. The ARH is also detachable and can be removed easily for any repairs of the machine or the swing arm itself.



Fig. 5. Automatic Rotary Hinge (ARH) mounted on the output module

IV. CONCLUSION AND RECOMMENDATION

The innovation presents a state-of-the-art automatic swing type output magazine handler stopper that prevents the protrusion of LF on output magazine during LF transfer. The said improvement mitigates the high risk of gross rejection related to die attach process such as damaged and crumpled leadframes with good units. With this modification, it is concluded that the automatic stopper has been effective and a great help for process and product improvement. Efficiency as also cited on [7-9] is also noted in the integration of this swing type output magazine handler stopper, as operators won't have to check processed leadframes on the output for any protruded leadframes. Worth considering that this innovation is recommended to be applied with the same function and principle for semiconductor machines of every processes.

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