Enhanced Detection Technique for Lead-to-Lead Short defect on QFN Devices

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Abstract—Escapee issues from manufacturing has been one of the major problems that affects the confidence of customers. Quality mindset is being emphasize and allowing reject units to escape is not acceptable. During die attach process, lead to lead shorting defect cannot be detected due to machine capability to check the outer parts of the die pad. With this, an enhancement through software upgrade is explored to check even the outside parts of the die pad. This innovation of Pre-bond bridging inspection includes detection of migration of epoxy on leads causing lead to lead short defect. Thus, escape of this kind of defect can be eliminated and prevented.

Keywords— Bridging, Die attach, Epoxy, Lead to lead shorting, Photo recognition sensor, Pre-bond.

I. INTRODUCTION

On the world of semiconductor industry, innovative and out of the box improvements are encouraged by the management team from engineers and technical specialists to improve product quality, maintain efficient process, and promote high volume manufacturing outputs. With the current challenges faced by these companies, different techniques are performed to analyse and address the root cause of the problem and come up with a robust and effective solution. In manufacturing of quad flat no lead packages, die attach is identified and pointed out to be critical and must have a state-of-the-art detection of potential reject units to prevent escapee resulting to customer complaints. This is the process of picking a die from sawn silicon wafer and placed on a base material of leadframe with a die attach conductive glue adhesive or epoxy. This will then be cured to achieve a stable position of the die. In this process, defects are inevitable and must be detected and trapped to avoid escapee going to the next process.
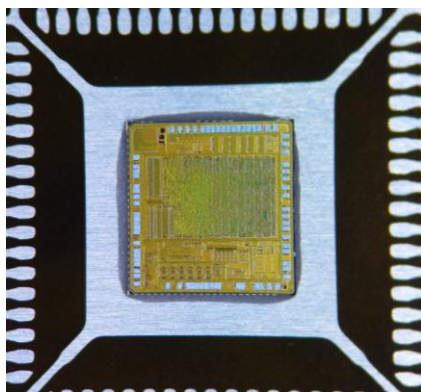

Fig. 1. Die attach unit

II. PROBLEM IDENTIFICATION

One challenge on die attach process is the detection of rejects outside the bonding area. After die attach, the process unit will be inspected by the machine using photo recognition sensor or PRS. The sensor will check for abnormalities of the die like position, angle, die attach epoxy area coverage or any foreign material present on the bonding area. due to the limited capability of the machine to widen the window of the are to be inspected, the outside part of the bonding area is left unchecked. These are the leads of the package, and the main defect is the migration of the conductive epoxy on leads causing lead to lead short as seen on Fig. 2.
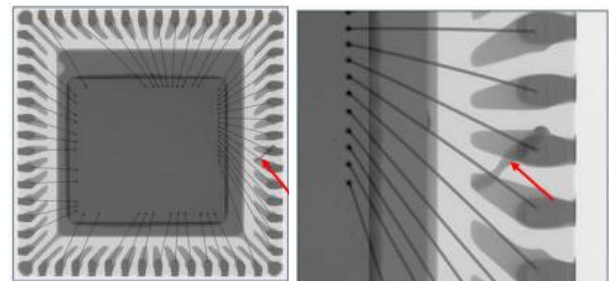

Fig. 2. Lead to Lead short caused by epoxy as seen on Xray inspection

Lead to lead shorting caused by a conductive material from the process like epoxy can affect the test response of the unit or worst, damage the whole structure. If these units proceed on other processes, it may cause product defect escapee, and can mix with other good units. Thus, quality established by the manufacturing is compromised, and can hurt the end users and customers of the said product.

To prevent the escapee to happen, a modern innovation of machine capability software upgrade is introduced and tested for detection improvement. With the help of machine experts and manufacturing engineers, an error proofing resolution is created.

III. PROCESS SOLUTION

The improvement to prevent the escapee of lead-to-lead short defects is by enhancing the detection capability of die attach machine through machine software upgrade. As mentioned on section II that the current field of view is the bonding area, leaving behind the areas around it. On this improvement, the lead areas will also be a point of inspection. This is the pre-bond bridging inspection set up. On this

enhanced capability, there will be parameters available to set a window inspection for leads outside the bonding area. As seen on Fig. 2. the option is added and enabled for pre-bond bridging

and its parameters. Fig. 3. Shows the area set up to determine the lead integrity/quality to be accepted.
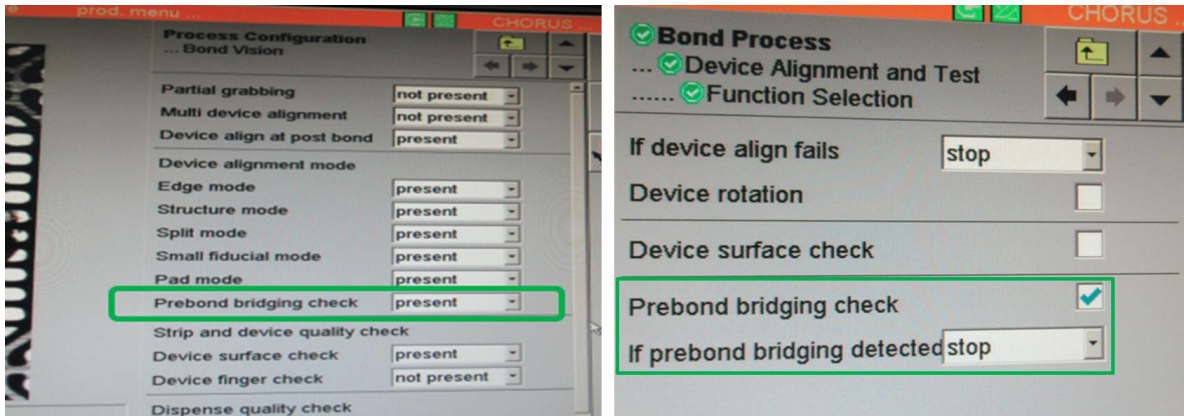

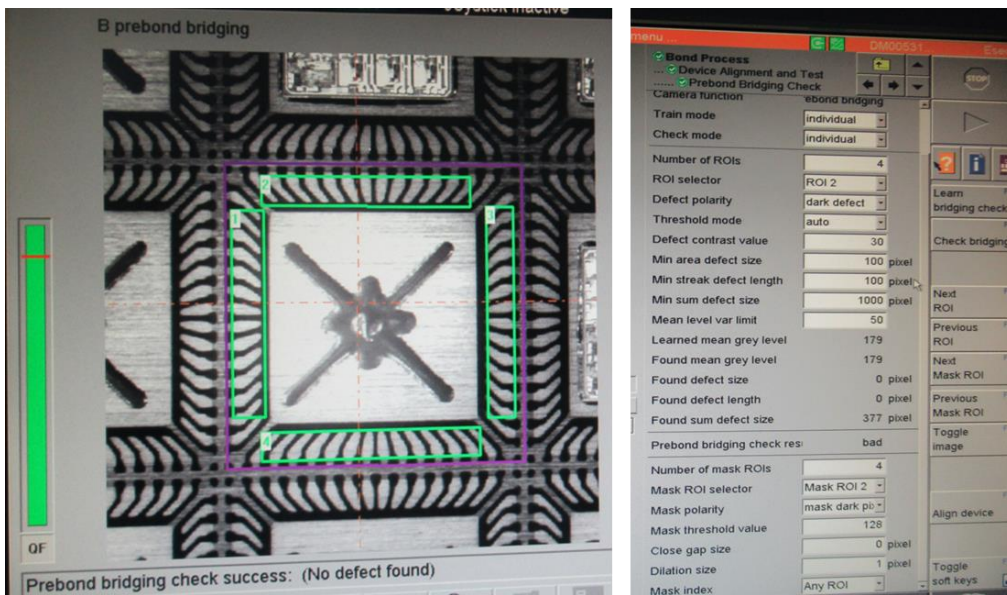Fig. 2. Activated Pre-Bond bridging setting

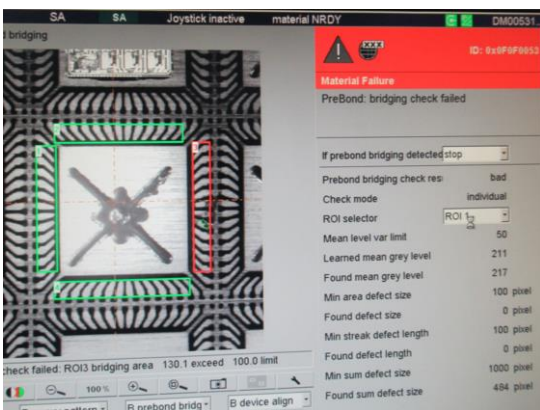Fig. 3. Pre-Bond Bridging set up and parameters

Fig. 4. Lead to lead short reject captured by Pre-bond Bridging inspection

During the setup, the technical expert will set appropriate lighting, area of inspection and other relevant parameters so that

it can detect lead to lead shorting during processing. Upon detection, the machine will stop and prompt an error that it had detected a lead-to-lead shorting as seen on Fig. 4. With this detection, the reject unit will not be continued to the next process and prevents reject escapee.

IV. CONCLUSION

This improvement of introducing an enhanced detection for lead-to-lead shorting at die attach offers great level of robustness and prevent the occurrence of defect escapee. Having this Pre-bond bridging detection after software upgrade, the manufacturing gained confidence of having their products delivered on customers to be good and passing all the requirements, leaving behind any potential defects from the first stage of manufacturing. To mention also that this improvement is recommended to be proliferated and implement on other industrial areas with the same concept and principle as an

improvement. Reference indicated also can be considered to help with the innovation and breakthrough for manufacturing robustness and quality sustenance.

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