ENGINEERING PRACTICES STUDY

TITLE: Proposed Changes To MIL-PRF-38535 Requirement Of Laser Scribing For Die Separation From Wafer.

November 06, 2014

EP Study Project Number: 5962-2014-007

FINAL REPORT

Study Conducted by DLA Land and Maritime

Active Devices Branch (VAC)

Document Standardization Division (VA)

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EP Study On Laser Scribing For Die separation From Wafer
To
MIL-PRF-38535 Requirements

I. OBJECTIVE: The purpose of this Engineering Practice (EP) Study is to obtain input/feedback from the military services, microcircuit manufacturers, and user communities concerning to allow laser scribing technique for die separation from the wafer to MIL-PRF-38535 documents.

II. BACKGROUND: In microcircuits manufacturing process, the **Wafer dicing** is to determine by the process or technique of which die is separated from a wafer for building an individual integrated microcircuits chips. General speaking, the dicing process can be accomplished by using laser scribing or mechanical sawing.

Considered some concerns in the past such as laser produced local heat that can cause potential damage of die/wafer periphery surface which lead prohibition of using laser scribing for die separation for class level S products. Currently MIL-PRF-38535 paragraph A.3.5.10 Laser scribing requirement stated:

" A.3.5.10 Laser scribing: Laser scribing shall not be used for die separation except for backside scribing of silicon on sapphire (SoS) wafers. Laser trim of resistors and shorting bars and laser scribed package external markings are not prohibited unless otherwise specified."

During DLA Land and Maritime conducted recent audits, it has been discovered that manufacturer(s) are planning to use laser scribing technique for die separation to their class level S devices which is a concern to current requirements of MIL-PRF-38535.

To acknowledge of laser scribing technique for die separation from wafer, DLA Land and Maritime-VAC would like to request your input/feedback on the attached questionnaire whether laser scribing technique would be allowed or not in MIL-PRF-38535 side by side other techniques.

III. RESULTS: The EP Study project was opened and initial draft was posted on the web and distributed to military services along with JEDEC JC-13, G-12 members and Space users communities on April 7, 2014 for review and comment (see attachment). Comments were received and solicited with all interested parties, including military services, microcircuit manufacturers, microcircuit distributors, original equipment manufacturers, and Space user communities at the JEDEC JC-13.2/G-12 joint meeting on September 17, 2014 to the JEDEC conference in Columbus, Ohio. The summarized received comments are below:

a) At this time, there is evidence that traditional sawing is unable to cut LowK technology under 45nm wafer without damage.

b) The ability to perform die separation of lowk devices without interlayer delamination (PI or Lowk dielectric lift) which increase reliability under 65nm technology.

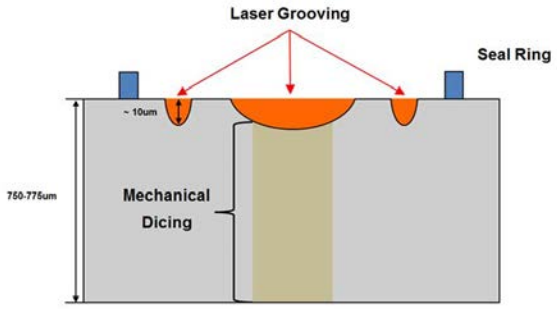
c) Laser Saw should be allowed because today's die separation methodology is a much cleaner and safer, and for some technologies like Silicon Carbide leaser saw is a must.

d) Finer cut lines, ability to take out metal in the streets and wherein traditional saw cannot perform less die edge chipping, etc.

e) Most of the comments received from manufactures and stated- "no impact to this change because they used traditional diamond saw."

f) The change should be applied to all screening microcircuits class M , Q, V and Y.

During JEDEC JC-13.2/G-12 meeting, some manufacturers also informed that they used both laser saw and diamond saw wherein start grooving by laser saw and then use diamond saw for die separation.



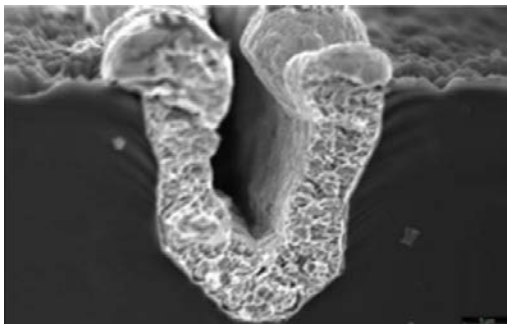


Fig: 1 Laser grooving and dicing with diamond saw. Fig: 2 Laser grooving prior to dicing

IV. CONCLUSIONS: The result of this EP study is revealed sufficient reasons for changing/updating of current requirement of prohibition of laser scribing for class level S microcircuits devices. MIL-PRF-38535 paragraph " A.3.5.10 Laser scribing" need to modify/update with allowing laser scribing for die separation from wafer with QA approval for all classes devices. However, how to use laser scribing technology for die separation can be discussed to JEDEC new technology devices subcommittee JC-13.7 for further review "grooving prior to die separation versus die separation performed by laser alone, and after laser scribe is used need to perform applicable examination for checking damage on active region or seal ring."

V. RECOMMENDATIONS: DLA Land and Maritime will update paragraph A.3.5.10 Laser scribing requirement to the next specification action, and simultaneously will continue to coordinate with JEDEC subcommittee JC-13.2 and JC-13.7 along with military, and industry representatives.

Attachment #1

Questionnaire on laser scribing for die separation from wafer.

In MIL-PRF-38535 paragraph A.3.5.10 Laser scribing currents requirement stated:

> " A.3.5.10 Laser scribing: laser scribing shall not be used for die separation except for backside scribing of silicon on sapphire (S0S) wafers. Laser trim of resistors and shorting bars and laser scribed package external markings are not prohibited unless otherwise specified."

The following survey questions and comments will be discussed with Manufacturer and User communities. Therefore, please provide your concerns, comments on laser scribing technique whether would be allowed or not in MIL-PRF-38535 side by side other techniques.

1) Does your company use Laser scribing?

   a) If YES, please provide your experience, comments and issues.

   b) If NOT, what techniques are using die separation from wafer?

2) Does your company perform Laser scribing only class level S / RHA /space level products die separation from the wafer? (if YES please provide your experience, comments and issues)

3) Do you agree Laser scribing should be allowed in MIL-PRF-38535? (currently MIL-PRF-38535 prohibited Laser scribing for class level S devices)

4) What would be the benefits for allowing Laser scribing techniques other than the traditional diamond sawing for die separation from wafer?

5) General comments on Laser scribing requirements in MIL-PRF-38535.