

A SYSTEM AND METHOD FOR SELECTIVE UNLOADING OF IC PACKAGES

Field of the Invention

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The invention relates to the process of integrated circuits and in particular, that part of the process whereby individual integrated circuit units are diced or singulated from a substrate containing many of said integrated circuits.

10 **Background**

Two of the key criteria for the economic viability of a singulation device include the rate at which units are processed, measured in units per hour (UPH) and the capital cost of the device for performing the action. In terms of capital cost, this may be hampered
15 depending upon the types of IC packages being singulated, as well as the end use, and so how these packages are provided to the end user after processing.

Traditional singulation devices provide for a linear path for the processing of a substrate from loading the substrate to cutting and then unloading which also includes
20 intermediary steps such as checking alignment and cleaning of the singulated units.

It would, therefore, be preferable if a system were available that provided a wider degree of flexibility, whilst still managing capital costs.

25 **Summary of Invention**

In a first aspect the invention provides a system for unloading integrated circuit (IC) units, the system comprising: a first and second unloading station; a delivery system arranged to deposit said IC units in the first or second unloading station, and; a control
30 system for determining which unloading station each IC unit is to be deposited.

In a second aspect the invention provides a method for unloading integrated circuit (IC) units to a first or second unloading station, the method comprising the steps of: determining which unloading station each IC unit is to be deposited in, and then; depositing said IC units in the selected unloading station.

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The following description of the invention and its various embodiments will use interchangeable language in describing the various parts. For instance, a block for receiving substrate may include a chuck table or other similar device. The cutting process defined by the invention may involve dicing saws and so the terms cutting, sawing and dicing may be used interchangeably when considering linear cutting of said substrates. The present invention may also include other cutting techniques, including laser cutting and water jet.

15 **Brief Description of Drawings**

It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible and consequently the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figure 1 is a plan view of a system according to one embodiment of the present invention, and;
Figure 2 is a flow chart for a process according to one embodiment of the present invention.

30 **Detailed Description**

The invention relates to a means of increasing the applicability of a device and process to a wider range of conditions and end user requirements, without a marked increase in

capital equipment. In implementing a prior art device and process that meets the present invention, it is likely that additional equipment would be required to maneuver substrates to the required position.

- 5 Figures 1 and 2 show a device 5 and a process arranged to provide these advantages. The device 5 is divided into four distinct sections being the loader 10, the dicing section 12, the handler 15 and the unloading sections 195A, 195B.

10 At one end, a loading station 20 loads substrates from a cassette loading magazine 18 to a frame turntable 25 which reorients the substrate from the loading position to the dicing position. The substrate is engaged by a frame picker 40, having a camera 35 attached thereto. The camera checks the position of the substrate on the table 25 to ensure it is correctly aligned prior to being engaged by the frame picker 40. The frame picker 40 delivers the substrate to one of two blocks arranged to receive the substrates, in this
15 case, chuck tables 45, 50 depending upon the stage in the process. The chuck tables are located at a first loading position, which for the subsequent description will be defined as the "original position".

20 Within the dicing section 12 is a cutting saw 47 and an alignment inspection device 48, both of which are mounted to linear slides for selectively sliding between two zones.

Each of the chuck tables 45, 50, are arranged to move upon linear slides so as to coincide with each of the cutting saw cleaning station and alignment inspection device. The cutting saw 47 can only accommodate one substrate at a time and, therefore, must
25 slide from a first cutting zone which coincides with a point upon the rail, servicing the first chuck table and a second cutting zone coinciding with a point on the rail of the second chuck table. Accordingly, the cutting saw 47 slides backward and forth between the two cutting zones depending upon which chuck table it is servicing at that time. Similarly, the alignment inspection device 48 moves from a first alignment inspection
30 station to a second alignment inspection station corresponding to the first and second chuck tables. As a result, the alignment inspection 48 will slide back and forth between the alignment inspection stations depending upon which chuck table it is servicing.

Each chuck table 45, 50 is arranged to deliver the substrate to inspection station 48 before them passing to a cutting station 47. Because the substrates are delivered one at a time, the processing of any one substrate is staggered in relation to the next substrate.

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In one embodiment of the process, during the alignment inspection 48 stage, or alternatively, during the cutting phase 47, a second substrate is loaded to the second chuck table 50. Once the first substrate is clear of the cutting station, the second substrate may be delivered to the second cutting zone, to coincide with the cutting saw 10 47, which slides from the first cutting zone. The substrates follow the path through the system staggered from each other by a period set to meet the objectives of the designer.

As with similar processes, a substrate may follow the process of:

- i) Loading (40)
- 15 ii) checking of alignment (48)
- iii) cutting (47)
- iv) unloading (60)

In this embodiment, the movement of the substrates on the chuck tables 45, 50 is 20 achieved by moving the various stations 47, 48 to the chuck tables themselves. That is, the first and second chuck tables 45, 50 operate along rails or other means to move the substrate to designated alignment inspection stations 48 and cutting stations 47.

The device further includes a bulk unit picker 60 moving along a common rail with the 25 frame picker 40 to collectively engage the singulated integrated circuit units from both the first and second chuck tables 45, 50. The units are passed through a cleaning box 65 and deposited on a dry block 70 where they are dried by a blower, before progressing further.

30 The units are then passed through a flipper 90 and idle block, 95 before being delivered to a first net block 80, or a second net block 100, in an inverted orientation. The first

and second net tables 80, 100 are each located on linear slides so as to bring the tables in proximity to pairs of parallel rails having individual net pickers located thereon.

From here, the singulated units follow a parallel path whereby the first net block is delivered to a pair of twin rails 86, 102 upon which unit pickers operate to an aligner 160 for alignment of the units, and a side inspection unit 165 before delivery to the offloading sections 195A, 195B.

The device and process according to the present invention, include a control system to select the means by which the units are then unloaded and packaged. Depending upon the type of IC unit, the type of end use processing equipment, the industry in which they are applied etc., the present invention is arranged to use pre-determined criteria to direct the units to a plurality of unloading stations. In the present embodiment, two such unloading stations are provided, being to JEDEC IC trays 195A or to wafer rings 195B. As a note, the wafer rings may be sputtering film frames, if the next step after unloading includes a sputtering process.

If the JEDEC IC tray unloading is selected, the pickers deposit the units into the various categories identified by trays 142, 147, 152. Similarly, the second net block 100 may be positioned so as to engage a second set of twin rails having corresponding unit pickers for again picking up individual units for deposit to the category trays 142, 147, 152.

The trays each have discrete rails upon which they can collect individual units from the two sets of parallel rails for eventual depositing to end bins 140, 145, 150. Here, “good” units may be deposited into two bins 140, 145 with “rework” units deposited to a third bin 150 and “reject” units deposited to a final bin 155 for disposal.

If the wafer ring unloading 195B is selected, the picker deposits the units into either the reject bin 155 or to the wafer ring loading station 195B. Here, a wafer loading picker 175 positions a wafer ring on a working table 180. The unit pickers then place the units on the available wafer ring. Once filled, a gripper 170 engages the wafer ring and places the ring into an unloading elevator, through guide rails 185. The wafer rings can then be

unloaded once the elevator is filled. The wafer ring is then unloaded for the end user and/or to undergo a sputtering process.

5 The unloading stations 195A, 195B are positioned proximate to each other so as to facilitate unloading from both stations with minimal adjustment.

Selection of the unloading station can occur between batches, or during batches, where the same type of unit is intended for varied end uses, with the control system able to track the loaded units, minus those rejected and marked for re-working, and so can
10 signal when imminent unloading of a bin or elevator/cassette is required.

Claims

1. A system for unloading integrated circuit (IC) units, the system comprising:
a first unloading station arranged to unload the IC units to JEDEC IC tray;
5 a second unloading station arranged to unload the IC units to wafer rings;
a delivery system arranged to deposit said IC units in the first unloading station
the or second unloading station, and;
a control system for selecting which unloading station each IC unit is to be
deposited,
10 wherein the control system is arranged to make the selection based upon
predetermined criteria, said predetermined criteria comprising type of the IC
units, type of end use processing equipment, and industry in which the IC units
are applied.
- 15 2. The system according to claim 1, further including an inspection system wherein
the delivery system is arranged to pass the IC units through the inspection system
prior to being deposited in the first or second unloading station.
- 20 3. The system according to claim 2, wherein the inspection system is arranged to
identify IC units to be rejected with the delivery system arranged to place rejected
IC units in a reject bin prior to the unloading stations.
- 25 4. A method for unloading integrated circuit (IC) units to a first unloading station or
a second unloading station, the method comprising the steps of:
selecting which unloading station each IC unit is to be deposited in based upon
predetermined criteria, said predetermined criteria comprising type of the IC
units, type of end use processing equipment, and industry in which the IC units
are applied;
depositing said IC units in the selected unloading station;
30 unloading IC units deposited in the first unloading station to JEDEC IC trays; and
unloading IC units deposited in the second unloading station to wafer rings.

5. The system according to claim 4, further including the step of inspecting the IC units prior to being depositing step.
6. The method according to claim 5, wherein the inspecting step includes identifying IC units to be rejected;
5 further including the step of placing the rejected IC units in a reject bin prior to the depositing step.